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Electrical Engineers in the Making

THIS fall a group of young men have entered our engineering schools and colleges to learn "how to be electrical engineers." Three years next June a shrunken company of "engineers" will leave and mingle with the hundreds in the industry who have preceded them. The bare totals of this annual inflow and outgo of our electrical engineering schools, recorded on another page, like most statistical summaries, speak to us clearly only when we translate them into human experience. If they have no other value, at least they start us thinking and speculating on the future problems of the industry and the training of the men who are to meet them. No technical school, of course, attempts to turn out finished engineers in any branch. Only the man broadened and deepened by the give and take with his fellow workers and the detail of his work can earn that title. Where he shall earn the title is equally important with how he shall do so. In the past the metal-working arts seem to have absorbed by far the larger percentage of the men who are graduated from our technical institutions. It is probably fair to say that, broadly, these industries are conducted more efficiently than others. Is it not also fair to assume that it is the engineering method of approach to the problems that has raised the metal-working arts above the others? With the widening application of electricity to its sister arts, the electrical engineer of to-morrow has the opportunity not only to apply in an allied industry the detailed knowledge of his profession but to judge of the success of the application with a quality of mind that measures in terms of quality and service as well as results. Such a quality of thinking can be the finest contribution of the man with an engineering education to our national life.

Preparing for the Great Campaigns

HALF of the richest opportunities in the business world are sacrificed because men are not ready to receive them. This is true in a degree of the electrical merchant and retailer of apparatus, for he has not yet applied the law of preparedness with the astute intelligence that the regular merchant habitually displays. The department-store buyer, for instance, orders his Christmas goods in April, May and June, and right now he is picking out the lines to be featured next spring. Countless contractors and central-station men, however, are still undecided as to just what they are going to offer during Electrical Prosperity Week and in the Christmas shopping weeks that follow. This double campaign presents a great opportunity—unquestionably one of the greatest the electric shop has ever seen—but we wonder how much of it will be lost through procrastination. Preparation for such a campaign means not only plans for advertising, plans for sales and plans for features of display, but above all else ample stock of such variety and volume that every man, woman and child that comes within selling range will purchase as much as possible. This matter of stock is the most important issue now before the electrical merchant. Not only must he have enough on hand to satisfy the double opportunity, but he must also remember that it takes time for the manufacturer and the jobber to make deliveries. Otherwise in the last few weeks, when there will be an overpowering rush of orders from all sides, he may suffer a costly disappointment in not being able to serve customers because appliances are "all out."

Practical Co-operation on the Safety Code

ASSOCIATIONS have their birth because of some requirement of an industry. They are formed usually when an unexpected happening demands conference and united action. In this beginning their members find that strength comes from concerted action. The association is continued, its functions are enlarged, and its ability to co-operate is broadened. Through general officers and committees its activities multiply in many directions. It becomes the authorized voice of its members on questions affecting their collective interests. The importance and influence of associations are well illustrated in the pending co-operative measures relating to the proposed National Electrical Safety Code, now in process of formulation. The Bureau of Standards has issued the preliminary text for a code which it recognizes as tentative; to perfect and adapt it to actual working conditions throughout the wide expanse of the country the bureau has wisely asked co-operation from the various associations representing different phases of the industry, and no doubt the associations will afford the bureau their effective co-operation through the committees which have been giving this subject their consideration for some months. The postponement of the conference from Oct. 27 and 28 to a still later date not yet determined will give a further opportunity for revision and amendment so that when the code is finally issued it may be thoroughly practical and applicable to the various conditions of operation. After further consideration and consultation with the committees representing the experience of the industry—its intensely practical side—the bureau will glean much information as to the actual conditions

to be met and the varied local requirements of a rapidly developing art. The test will come when the rules are actually applied to the conditions which companies must meet if they are to furnish the service the public needs. Service requirements, expansion into new territory and the development of new markets concern vitally both public and companies. It would be a misfortune from which the bureau and the public would suffer fully as much as the industry if the proposed code, even in the tentative form which it necessarily must assume at first, were not made as useful and practical as the active co-operation of all who are interested in its application can make it.

The Engineer in Public Affairs

GREAT and important matters having to do in the material sense with public interests do not usually fall into the hands of the technically trained man. With rare exceptions civic tasks are intrusted to those who are not familiar with the technical side of the very things they are appointed to accomplish. Here and there, where the local government is particularly well organized and long-headed, the engineering resources of the community are called upon in other than a very limited and ineffective advisory capacity. All too frequently the engineer is far too busy with other matters to give up the time necessary to make himself a visible object in local politics. If he have the time for this, it usually speaks ill for his professional practice, yet in the development of sane and efficient methods of handling municipal affairs it ought to be plainly evident that citizens who are by reason of their professional training particularly qualified for special civic posts should be commandeered to undertake them.

The trouble comes from the fact that the trained men who might do great service to their communities are generally guilty of laxness of interest in civic affairs. They are not interested in these matters, and therefore nobody thinks of them when nominations are impending. The engineer's whole training and experience tend to make him an efficient executive, even in directions somewhat apart from his ordinary professional experience, so that even in a task not highly specialized he is much more likely to "make good" than one who comes in quite untrained and has gradually to assimilate the duties of his office through the assistance of the clerks who are on the civil-service list and consequently do not change with the seasons. To better matters, the public-spirited people who are working for an efficient city administration ought to see to it that their specially trained fellow-citizens are made to do their part in looking after the community interest by having put upon them tasks that need their direction; and, second, men who are so trained should realize that they have some duty toward their fellows and ought to take an active interest in civic affairs. The opportunities for appointments that make for efficient public service rise as one passes from city to State or national affairs, a fact which is becoming more and more appreciated by governors and presidents in making their appointments. The engineer is fast coming into his own, because the fundamental principle which underlies efficiency of action is the necessity of putting every man upon work which he is thoroughly competent to perform, and this implies close scrutiny of his known abilities and training. It is now generally recognized that it is no time for a man when he assumes office to begin to learn the business on which the proper performance of his duties depends.

Mathematics of Transmission Lines

IF an electrically conducting line has uniform conductor resistance and insulation leakance and is operated by steady continuous currents, then it is well known that the line possesses, as a whole, a certain hyperbolic angle, and any point on the line may be regarded as possessing a corresponding hyperbolic position angle, the value of which depends upon the terminal load at the receiving end. The voltage at the considered point on the line is then directly proportional to the sine of the position angle, the current to the cosine, and the line resistance to the tangent of the same. All the angles here considered are real hyperbolic angles, and the sines, cosines and tangents are real hyperbolic functions.

The same conditions are met with, in the laboratory, with direct-current artificial lines, comprising uniform sections of resistance and leakance, except that the sine, cosine and tangent values of the voltage, current and line resistance respectively are developed only at section junctions. Within each section the voltage and resistance fall steadily, while the current along the line is, of course, constant, except for sudden changes at the leaks.

The above relations lead to such simple and natural formulas, involving real hyperbolic functions, that to express the same facts quantitatively in any other way is to confuse and obscure them. It would be like trying to express the general relations between the sides of a triangle without the use of the ordinary sines and cosines of the circular angles presented in the triangle.

If now we take a line of uniform electrical constants operated steadily by simple alternating currents, the laws of the direct-current line, as above pointed out, apply with precisely the same force and effect, but must be interpreted vectorially. The hyperbolic line angle, the position angle of a point, the sine, the cosine and the tangent are no longer simple real numerical quantities, but are complex or plane-vector quantities possessing both a magnitude and a slope, or, as the mathematicians usually call them, a "modulus" and an "argument."

Although there is probably no shorter, simpler or more natural way of presenting the fundamental relations of a simple alternating-current line than in terms of complex hyperbolic functions, yet the formulas are so brief and compact that it is not always easy to perceive their interrelations, especially when the use of hyperbolic functions is not familiar to the student.

Prof. V. Karapetoff contributes an interesting article to the literature of the subject of which the first part is printed in this week's number. He points out that the arguments of the linear series impedance and shunt admittance of the line, φ and ψ, deserve greater consideration than they generally receive. For example, the linear power loss will preponderate in the conductor or in the dielectric according as the circular angle φ is greater or less than ψ, a simple relation not usually recognized. The article points out that a Heaviside distortionless line is one in which the angles φ and ψ are equal, so that the linear power losses in conductor and insulator are equal. A new and useful approximate formula is also presented for the Ferranti ratio of a transmission line, in terms of the frequency and of the linear constants.

The subject of alternating-current lines at various frequencies is so extensive and presents so many different aspects that no one textbook, writer or set of experiments can hope to cover the entire field, and material is valuable from all sides if it presents the facts in a new light, as in the case of Professor Karapetoff's article. There is also much need in technical-college laboratories for artificial lines adapted to different frequencies, so as to elicit experimentally the various relations of lines as used commercially.

Pulverized Coal as a Boiler Fuel

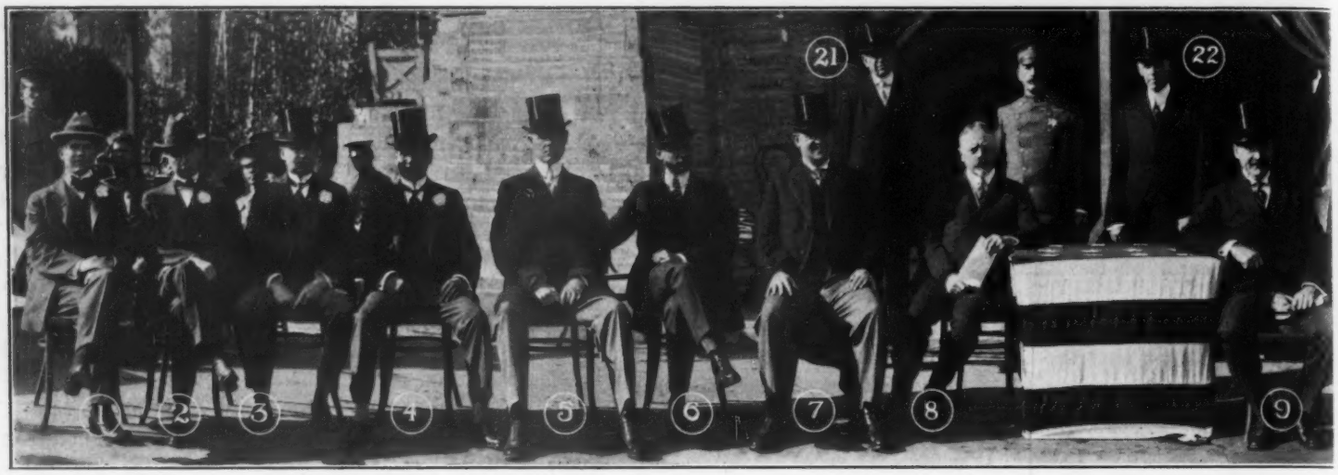
IN the average steam-electric plant the greatest possibilities for reducing operating costs are in the boiler room. Most of the losses in power production can be traced to the coal pile, the furnace, or a combination of both. The increasing cost of coal has been a decided factor in making some of these losses plain, and has also called attention to other possible fuels. Pulverized coal has been tried out for steam generation, and the success with which this fuel has been used in other industries, such as cement manufacture and metallurgical works, held out much of promise. Pulverized coal burns while suspended in the gases in the furnace, so that the problems connected with air-space areas in grates and amount of draft needed to overcome fuel-bed resistance are wholly absent. Again, there is no deadening or chilling of the fire when fresh pulverized fuel is thrown into the furnace, as with hand-fired boilers using coal, when the periods of firing are always accompanied by lowering of the temperature of the furnace and the fuel bed.

The necessity of providing apparatus for drying, grinding, storing, conveying and feeding pulverized coal constitutes a valid objection to the system, however, because such apparatus requires an initial investment and calls for upkeep and repairs. Also, pulverized coal may explode in the furnace or in the pipes through which it is admitted to the furnace. Thus, if the powdered fuel be blown into the furnace through a pipe, the flame may flare back in the pipe unless the velocity of the mixture in the pipe is greater than the rate at which the flame of the explosion will be propagated.

As to the efficiency of combustion, there seems to be no doubt that it is high, because of the perfect conditions attending the burning. But by the time the cost of drying, powdering and conveying the coal is taken into account, the economy of the installation is reduced to such a figure that it has little or no advantage over the common forms of installations to burn commercial sizes of coal.

Color Values in Growing Uses of Light

SINCE the general introduction of metallic-filament lamps either of the vacuum type or the later gas-filled type questions of esthetics in color have come to the front, and the central-station manager must take heed of them. One may descant upon the admirable whiteness of the light of the new lamps and explain how much better the lamps are than their predecessors for matching colors, but it is not wise to express these opinions at a meeting of a women's club for instance. Modern lamps are often severely criticised for the very whiteness which for certain technical purposes is their conspicuous merit. The exact psychological cause of the criticism we leave to the devotees of that intricate and illusive science. The cold facts stick out with unpleasant prominence, and the practical phase of the matter is the evolution of suitable means for meeting this particular difficulty. There is a boom at present in residence lighting, and electricity is steadily being applied to a constantly growing field, so that the adaptation of electric light to meet varying conditions is particularly necessary. All the means available for ridding the metallic-filament lamp of its too garish hue reduce the efficiency of the illumination, a fact which must be assumed at the beginning. To come back to the color of the ordinary carbon-filament incandescent lamp means returning also to its relatively low efficiency. Some very interesting and useful trials have been made of lamps with bulbs either slightly tinted or superficially colored to cut out the necessary amount of blue rays. These expedients are effective, but a little inconvenient in the matter of lamp renewals. Slightly tinted shades of glass or of textile fabrics modify the color successfully, but with the same loss of efficiency, the loss being roughly proportional to the variation of the tint from the initial color of the filament. In indirect and semi-indirect lighting excellent results can be reached by modifying the ceiling tint, and this is by no means an inefficient scheme if not carried too far. In semi-indirect lighting many of the translucent bowls have just enough tint to answer the purpose if combined with a ceiling tint nearly matching them. From the standpoint of sound strategy the practical side of the affair may well be left to the user, with a suggestion of the possible means of obtaining the best effect. The user in a majority of cases considers the esthetics in residence lighting rather than the lumens per watt, and if satisfied in the former particular he will not worry much about the latter, when impressed from the beginning with the fact that the modern lamp owes its efficiency to the whiteness of its incandescence.



"Engineers' Day" at the Panama-Pacific International Exposition, San Francisco—Members

To commemorate the able work performed by the engineering staff of the Panama-Pacific International Exposition at San Francisco, a day, Sept. 24, was set apart and public tribute paid to the men under whose charge the construction of the great Exposition was carried out. The day was called Exposition Engineers' Day, and in addition to the Exposition engineers, who are seen at the left in the photograph, other notable figures in the engineering work of the country were in attendance. The men shown in the above photograph, from left to right, are: (1) L. F. Laurey, assistant electrical and mechanical engineer of the Exposition staff; (2) H. D. Dewell, chief structural engineer; (3) Shirley Baker, chief of construction; (4) W. O. Waters, superintendent of building construction; (5) Guy L. Bayley, chief electrical and mechanical engineer; (6) A. H. Markwart, assistant director of works; (7) Harris D. H. Connick, director of works; (8) William H. Crocker, chairman of committee on buildings and grounds; (9) Charles C. Moore, president Panama-Pacific International Exposition; (10) John A.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Post Office Department to Issue Specifications for Electric-Truck Purchases

The Post Office Department expects to issue shortly—possibly within the next two weeks—specifications for electric-truck equipment for the Chicago Post Office. These specifications are now being prepared in the office of the purchasing agent of the Post Office Department, J. A. Edgerton, Washington, D. C. Several months ago the Post Office Department issued specifications for the purchase of gasoline trucks for the needs of the department for the fiscal year ending June 30, 1916, and it is assumed that the electric-truck specifications shortly to be sent out with requests for bids will supplement the gas-truck specifications already issued.

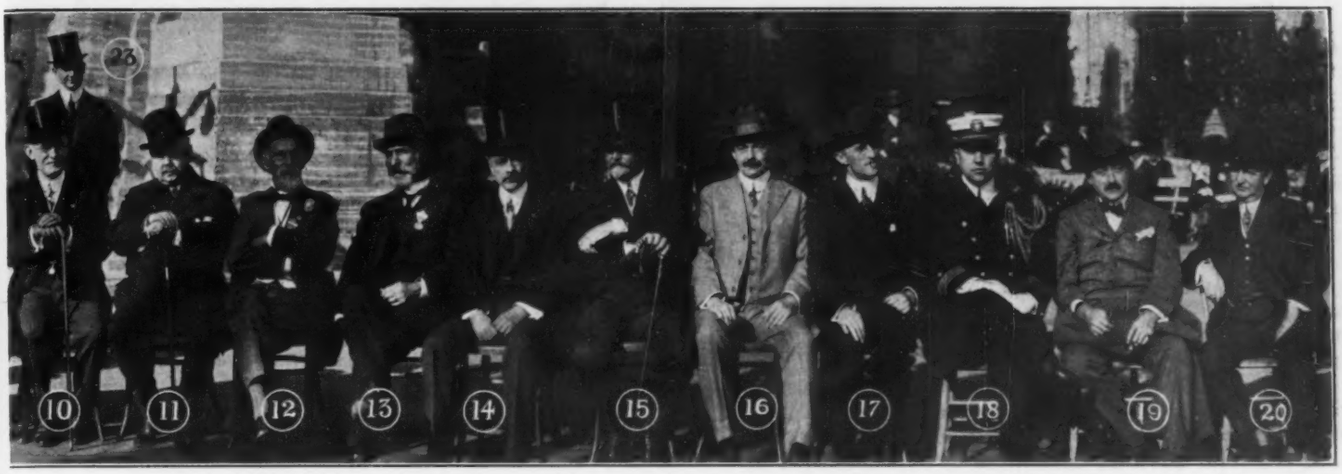
Keel of First Electrically Propelled Battleship Laid

On Oct. 14, at the Brooklyn Navy Yard, the keel of the U. S. S. California, the first electrically propelled battleship in the world, was laid. Use will be made of the alternating-current system, which involves the employment of turbo-generators, the electric energy from which will be used to operate motors driving the propellers. The decision to propel this ship electrically was reached after tests had been made by Admiral R. S. Griffin, engineer of the navy, on the electrical propulsion machinery in the collier Jupiter, the first deep-sea vessel to be so driven. The electrical equipment of this collier, which exceeded expectation in both speed and endurance, was designed by W. L. R. Emmett of the General Electric Company, a graduate of the United States Naval Academy, in whose hands the design of the propelling mechanism of the California rests.

The contract speed of the ship is 21 knots an hour, and she is to be completed in February, 1916. Water-tube, oil-fired boilers contained in a set of separate, heavily bulkheaded boiler rooms, extending clear across the ship and served by a single smokestack of large diameter, will be installed. In order to protect the smoke uptake against penetration by shell and to prevent furnace gas from passing into the intermediate decks, as happened to some of the Russian ships in the battle of Tsushima, the base of the smokestack will be protected by heavy inclined armor.

Other interesting features in the design of this ship are that the armor is somewhat heavier than that employed on previous dreadnoughts and that protection against under-water attack has been bettered by the further extension of subdivision and by the use of improved "anti-torpedo" bulkheads designed to localize the effect of torpedo explosions.

The California will have 32,000 tons displacement, which is 4500 tons greater than that of ships in the Oklahoma class. Her length over all will be 625 ft., her beam 97¼ ft., and her draft 29 ft. She will carry twelve 14-in. guns, twenty-two 5-in. guns, and four submerged 21-in. torpedo tubes in addition to other armament. The total cost of the ship when completed will be over $15,000,000, of which $7,800,000 represents the cost of the ship exclusive of armor and guns.



of the Exposition Engineering Staff and Representatives of National Engineering Bodies

Britton, vice-president and general manager Pacific Gas & Electric Company and vice-president of the Exposition; (11) Dr. Frederick J. V. Skiff, director-in-chief of the Exposition; (12) John A. Brashear, president American Society of Mechanical Engineers; (13) Prof. C. D. Marx, president American Society of Civil Engineers; (14) J. J. Carty, president American Institution of Electrical Engineers and chief engineer of the American Telephone & Telegraph Company; (15) Commissioner C. C. Vogelsang of the Exposition; (16) F. L. Hutchinson, secretary American Institute of Electrical Engineers; (17) Calvin W. Rice, secretary American Society of Mechanical Engineers; (18) Lieut-Commander Clark Howell Woodward U. S. N., naval aide to President Moore; (19) Charles Warren Hunt, secretary American Society of Civil Engineers; (20) Howard H. Holmes, consulting engineer and designer of the Exposition ferry slips. Above, from left to right, (21) C. S. Scott, (22) Theodore Hardee, and (23) Carl S. Herman, of the Exposition staff.

Mammoth Turbine Ordered for Chicago

The Commonwealth Edison Company of Chicago has just purchased a new turbine unit the generator end of which will be the largest sixty-cycle machine so far designed. The unit, which was sold by the Westinghouse Electric & Manufacturing Company, will comprise a tandem-compound steam turbine of the straight Parsons type and a generator rated at 35,300 kw. at 85 per cent power-factor. The latter will produce current at 12,000 volts, three-phase, sixty cycles, running at 1200 revolutions per minute, and will run in parallel with the Commonwealth Edison Company's sixty-cycle system. The turbine will take steam at 220 lb. pressure with 200 deg. superheat and will exhaust into a 29-in. vacuum.

Forced ventilation for the generator will be supplied by an external motor-driven blower, which is to be placed in the air duct leading from the air intake to the generator. The exciter will be directly connected to the main machine, and the unit complete will measure 75 ft. in length by 18.5 ft. in width by 21 ft. in height over all. The machine is to be installed in the company's Northwest station, and according to the terms of the contract will be ready for operation in time to carry the company's peak load in the fall of 1916. In design the unit represents a wide departure from the large Westinghouse machines now operating in the Interborough station in New York in that the entire unit will be placed on one shaft instead of being divided into two cross-compound machines. As yet auxiliaries for the unit have not been purchased.

The Public Service Company of Northern Illinois, another Insull property, has also purchased a 10,000-kw., 80 per cent power-factor, 12,000-volt, sixty-cycle turbo-generator, which is unique in that the turbine will operate at 300 lb. pressure and 200 deg. superheat. This unit was sold by the General Electric Company and is of the Curtis type. The Babcock & Wilcox boilers which will supply steam to the unit are rated at 350 lb. pressure each and will contain 10,000 sq. ft. of heating surface. Three of these steaming units have been purchased, although two will generate steam enough for the turbine. Each boiler will be fired by two Babcock & Wilcox stokers, the ratio of steam surface to grate area being about forty to one.

Annual Jovian Congress at Chicago This Week

The thirteenth annual Jovian Congress opened at Chicago Oct. 13 with 415 registered delegates in attendance at the end of the first day. At noon the Jovians were the guests of the Chicago Chamber of Commerce at a luncheon at which Dr. Frank W. Gunsaulus, president of the Armour Institute of Technology, spoke on the "Man of the Future," drawing a fine word picture of the truth-seeking engineer and scientist into which the boy of to-day will be developed. Homer E. Niesz, reigning Jupiter, formally opened the congress, introducing C. N. Miller, prosecuting attorney of Chicago, who welcomed the delegates to the city. Mayor Henry W. Kiel of St. Louis responded for the delegates. Ell C. Bennett in his report as Mercury said that, while the past year had been one of business depression, there are no financial rocks ahead of the Jovian Order. Just now, he said, the industry is on the threshold of a brilliant era of prosperity and the future plans of the order should be laid accordingly. During the last administration the order has continued to expand, although the growth has not been so rapid as in past years. Nine new local chapters have become affiliated with the national order, and the last "potential" issued this year will approximate 17,550. The present net membership of the order is 16,147, of which 1800 were initiated during the last administration.

POSTPONEMENT OF CODE CONFERENCE

At Request of National Electrical Societies Consideration of the National Electrical Safety Code Has Been Deferred by Bureau of Standards

The Bureau of Standards announces the postponement of the conference that was to be held at Washington on Oct. 27 and 28, 1915, until a date to be announced later. This sudden change of plans is due to the request of the National Electric Light Association, the American Institute of Electrical Engineers and the Association of Edison Illuminating Companies that additional time be granted for the consideration of the code of rules that has been formulated by the bureau before they are submitted to a formal conference.

The bureau has proposed that the rules be accepted tentatively for one year's trial before they are adopted formally by commissions or municipal authorities, and that the joint advisory committee to be established by the Washington conference (and which would represent all the interests concerned) should take up with the bureau the work of further revision and development of the rules if it was not found by the conference that the code as presented by the bureau or as modified by the conference was satisfactory for preliminary use. It was felt, however, by a considerable number of members of the above associations that more time should be taken and the rules very carefully studied by many who have not so far done so, and further modified if necessary, so as to make them as generally satisfactory as possible before they are submitted for the consideration of so large and representative a body as the Washington conference would be.

Although the bureau postponed the conference last June for nearly four months to permit such a careful study to be made, and was anxious to carry out the plans as announced for Oct. 27 and 28, it was felt that the electrical companies most affected by the proposed code should have the fullest opportunity to study it and submit to the bureau any further information and experience bearing on its revision and development which they deem desirable. The engineering societies requesting the postponement have given the bureau assurance of prompt and active co-operation, and every effort will be made to complete the work at an early date. The task is a large one, however, as the code amounts to an attempt at standardization of many features of station and line construction and operation, and several weeks, and possibly months, will be required for the work.

The following letter was sent to the bureau by the president of the National Electric Light Association, and one similar by the president of the American Institute of Electrical Engineers:

THE NATIONAL ELECTRIC LIGHT ASSOCIATION,

NEW YORK, Oct. 8, 1915.

S. W. STRATTON, Director National Bureau of Standards, Washington, D. C.

We hereby respectfully request your honorable bureau for a postponement of the conference called to meet in Washington Oct. 27 and 28, 1915, for the consideration of the proposed National Electrical Safety Code rules for construction and operation.

We desire to express our highest appreciation of the value of the splendid work that has been done by the bureau and the fruitful efforts it has put forth in the bringing of the code to its present state, and our request for further time in which to submit additional suggestions for consideration arises from our desire to make the proposed code as comprehensive as possible, so that it may meet with the largest measure of usefulness to the public and to the important industries represented by this and other national associations vitally interested in this valuable codification.

It is proposed to appoint immediately special committees for this purpose with the view of further co-operation with the bureau to bring about the desired result at the earliest practicable time.

Very truly yours,

E. W. LLOYD, President.

The following letter was sent by the Association of Edison Illuminating Companies:

ASSOCIATION OF EDISON ILLUMINATING COMPANIES,

BROOKLYN, N. Y., Oct. 8, 1915.

S. W. STRATTON, Director National Bureau of Standards, Washington, D. C.

We beg herewith to make application to your bureau for a postponement of the meeting of the conference committee called to consider the proposed National Electrical Safety Code for construction and operation, which has been called to meet Oct. 27 and 28, 1915, in Washington, D. C.

We are glad of the opportunity of commending the useful work accomplished by the bureau in bringing together such a valuable code of rules, and we desire to lend our co-operation toward further improving its usefulness and value to the industry we represent by submitting for the consideration of the bureau further suggestions and amendments which we believe will make it more complete and generally applicable.

We are arranging to have our special committee appointed to consider this matter meet in conference, so as to facilitate the preparation of our recommendations, and we hope that we may be assured of additional time within which to take the necessary steps.

Assuring you of our appreciation of the efforts of the bureau to make the code acceptable to the members of our association, I am,

Very respectfully yours,

W. F. WELLS, President.

The bureau regrets the inconvenience to many delegates caused by a postponement, but believes that the issues at stake are so great and the results obtainable by the expenditure of further time and effort are likely to be so much more satisfactory under the circumstances than would have been possible otherwise as fully to justify whatever inconvenience and confusion will be caused by the postponement of the conference.

ELECTRIC VEHICLE CONVENTION

Sessions at Cleveland, Monday and Tuesday, to Be Occupied with Many Important Papers and Reports

Arrangements for the annual convention of the Electric Vehicle Association of America, to be held on Oct. 18 and 19 at the Hotel Statler, Cleveland, Ohio, include a special program of entertainment for the ladies who shall be present. Monday afternoon will be devoted to trips to the stores and points of interest in "electrics," with a theater party in the evening. A luncheon will be given at the Country Club on Tuesday, and the afternoon has been set aside on the program for drives in Cleveland's parks and boulevards. The banquet will be held Tuesday evening. No entertainment features have been planned for the members of the association so as to insure at the meetings a full attendance of those registered.

Owing to business conditions this year a record-breaking attendance is not expected. Estimates place the number that will attend coming from places outside of Cleveland at around 350. Large delegations are expected from New York, Boston, Philadelphia and Chicago. Exhibits of electric-vehicle equipment, appliances and parts of new design will be held in the hotel adjacent to the convention hall and will afford an opportunity to view and compare the latest achievements in the art. It is expected that an electric cabriolet, manufactured by the Walker Vehicle Company, will be driven from Chicago, arriving in Cleveland Sunday evening. The 750-lb. Ward electric delivery wagon is also expected from New York City.

Two papers relied on to bring forth the greatest discussion are those by W. M. Thayer, on "Data on the Hartford Electric Light Company's Experience with the Battery-Exchange System for Commercial Vehicles," and by George H. Kelly, on "Problems We Are Facing, and How They May Be Met."

The program of papers, omitting the two just named,

follows: "Industrial Trucks in the Service of the Pennsylvania Railroad Company," by T. V. Buckwalter; "The Electric Taxicab," by I. S. Scrimger; "The Function of the Electric Garage," by R. Macrae; "Comparative Development of the Commercial Power and Electric Vehicle Loads," by H. H. Holding and S. G. Thompson; "The Small Electric Vehicle and Its Application," by Charles A. Ward; "Electric Vehicles in Municipal Service," by Arthur J. Slade and R. Duval Dumont, and "The Comparative Performance of Gasoline and Electric Vehicles in Similar Service," by W. J. Miller and S. G. Thompson.

Annual Meeting of the Empire State Gas and Electric Association

The annual meeting of the Empire State Gas and Electric Association was held in New York on Oct. 7 and 8. Besides the reports of standing and special committees presented on the morning of Oct. 7, there was a paper on "Method of Analyzing Cost of Service," by C. A. Graves of New York, and a paper by J. T. Hutchings of Rochester on "Insurance Under the New York Employees' Compensation Law," presented on Oct. 8. Chief interest in the convention, however, was centered in the session held during the afternoon of Oct. 7, which was devoted to a consideration of the question of co-operation between State and national bodies. The speakers included E. W. Lloyd, president of the National Electric Light Association, H. B. McLean, president of the National Commercial Gas Association, and W. R. Addicks, past-president of the American Gas Institute.

PRESIDENT DE LONG

All of the speakers voiced the desirability of closer co-operation between State and national bodies and lamented the waste of effort due to duplication of work. It was recognized that there were difficulties in the way of admitting such a body as the Empire State Gas and Electric Association into membership as a geographic section of the National Electric Light Association inasmuch as that body does not admit into membership a purely gas-lighting company, or into the National Commercial Gas Association as that body does not admit purely electric-light companies. However, both of those national bodies through their respective presidents promised that the matter should have immediate consideration, and at a later session it was announced that the question of affiliation was placed before the executive committees of the respective organizations and committees were appointed to take up the matter. On both sides hope was expressed that the by-laws of the respective national bodies could be so amended as to make close co-operation possible. Many of the speakers intimated that the Eastern New York Section of the National Electric Light Association as a geographic section could be dispensed with.

At the closing session the following officers were elected: President, J. C. De Long, Syracuse, re-elected; first vice-president, Stuart Wilder, Mount Vernon; second vice-president, H. M. Beugler, Poughkeepsie; treasurer, C. A. Graves, New York; secretary, C. H. B. Chapin, New York. The executive committee vacancies were filled by the election of the following members: C. G. M. Thomas, Long Island City; E. H. Palmer, Geneva; G. B. Tripp, Elmira, and H. W. Peck, Schenectady.

Mr. Edison to Be Present in Person for Edison Day at San Francisco Exposition

All arrangements have been completed for a gala celebration of Edison Day at the Panama-Pacific International Exposition in San Francisco. John A. Britton has been designated to serve as chairman, and the executive committee will comprise Dr. Thomas A. Addison, Pacific Coast manager of the General Electric Company; Guy L. Bayley, chief of the electrical and mechanical department of the Exposition, and W. D'A. Ryan, the illuminating engineer of the Exposition. Mr. Edison left Thursday night for the Pacific Coast, and although he is scheduled to make several stops en route, there is every indication that he will reach San Francisco in time for the celebration.

The committee which will meet Mr. Edison at the station consists of the following prominent men: John A. Britton, Governor Hiram W. Johnson, Mayor James Rolph, Jesse Lillienthal, Dr. Thomas Addison, Mortimer Fleishhacker, W. T. Sesnon, W. D'A. Ryan, G. L. Bayley, Charles Gaunt, A. W. Foster, H. T. Scott, G. C. Holberton, Lieut.-Commander Clark H. Woodward and J. M. Hill. These men represent electrical manufacturers, central stations, telephone and telegraph companies, electrical-development societies, and men of political prominence in California.

The tentative program, which has been approved by the president of the Exposition, is as follows: Reception of Mr. Edison on day of arrival (probably Oct. 20); luncheon given by the president of the Exposition to Mr. Edison and party, at which will be present all members of the reception committee; at same hour Mrs. Edison and other ladies of the party are to be the guests of the ladies' board of the Exposition at luncheon; opening address by John A. Britton, chairman of the day, at the Court of the Universe at 2.30 p. m.; presentation of medal to Mr. Edison by C. C. Moore, president of the Exposition; acceptance by Mr. Edison; introductory remarks by Samuel Insull; aeroplane flight at 3.30 p. m., to be seen by Mr. Edison and party from special reviewing stand provided for the occasion; dinner by friends of Mr. Edison; fireworks, arranged especially for the occasion, 8 p. m. Following the fireworks, Mr. Edison is to be escorted through the grounds, either privately or in party, by W. D'A. Ryan, and shown the lighting and electrical equipment of the Exposition.

Besides the above general program, there will be motion pictures of some of the work that is being done in the Edison plant, as fell as lantern slides, with a lecture on the life and inventions of Edison.

An exhibit consisting of many of the earlier inventions of Mr. Edison, together with the latest types of the same article, will be shown in the Transportation Building in the space now occupied by the Edison company. This will be purely an educational and historical exhibit, showing the development in the various lines.

PHILADELPHIA MEETING OF A. I. E. E.

Supply of Energy from Hydroelectric Stations Supplemented by Supply from Steam Stations During Low-Water

The meeting of the American Institute of Electrical Engineers held in the Engineering Building, University of Pennsylvania, Philadelphia, Oct. 11, under the auspices of the Philadelphia Section and the power stations committee of the A. I. E. E., was one of the best attended ever held in that city. President John J. Carty acted as chairman, and Past-presidents C. O. Mailloux and Carl Hering were in attendance, in addition to a vice-president, two managers and the secretary of the society. The afternoon and the evening sessions were devoted exclusively to the consideration of hydroelectric subjects.

In his opening remarks President Carty told of the various meetings of engineering bodies both prior to and during the international engineering congress in San Francisco and how greatly he was impressed by the recognition given to the engineers on the Pacific Coast. The work of the electrical engineer, especially in communication and transportation, has been very marked, and as a result civilization has been immensely benefited. He was particularly glad to note that distances were obliterated and that so far as the American Institute of Electrical Engineers is concerned there is no West, East, North or South, but all sections are working in absolute harmony and with unity of purpose. It is the purpose of President Carty to have a celebration next year which will commemorate fittingly the work of the electrical engineer. Some of the plans for that celebration he outlined at the meeting.

Supplemental Power for Hydroelectric Systems

Two papers were presented at the afternoon session, one on "Supplemental Power for Hydroelectric Systems," by John F. Vaughan of Boston, and the other on "The Combined Operation of Steam and Hydraulic Power in the Pennsylvania Water & Power Company's System," by John Abbet Walls of that company. Mr. Vaughan in his paper outlined the functions of a steam plant in furnishing relay and supplemental power for a system whose normal source of power is water, and illustrated graphically and otherwise the relative importance of the various functions and characteristics of the supplemental plant. He also showed by diagrams in a hypothetical case the division of loads between the hydraulic and supplemental sources of power.

The greater part of the paper was given over to a discussion of some general data obtained from a number of New England water-power systems, indicating the extent to which the water-power is supplemented by steam and the methods of utilizing supplemental capacity. From these data he drew the following conclusions:

1. That steam relay is relied on in widely varying proportions of water-power capacity, depending partly on the character and regulation of the streams, partly on the character of power demanded, and more and more on the extent to which the systems are interconnected with others for the interchange of power.

2. That, on the whole, the companies have been successful in utilizing the existing steam capacity of their customers.

3. That the principal uses to which supplemental capacity has been put are (1) relay for low-water, (2) break-down, (3) peak capacity, and (4) base load.

4. That the supplemental plants, being largely old plants belonging to companies formerly supplying their own individual markets and since consolidated into more or less comprehensive systems, are generally scattered among local centers of distribution.

5. That only in rare cases have provisions been made in special equipment or organization for quick starting, and that for this reason quick starts are rarely made. In certain cases, however, where such relay is of importance oil firing is being introduced, and in rare cases gas and oil engines.

Mr. Walls in his paper told of the experiences of the Pennsylvania Water & Power Company, which has a large hydroelectrical development on the Susquehanna River at Holtwood, in endeavoring to accomplish most effective combined steam and hydroelectric operation. He indicated that a river may be developed to an extent many times its low-water flow where there is extensive co-operation between customer and power company in determining by experiments the economy of further supply of hydroelectric power. The author made a plea for drawing up power contracts in a fashion to encourage effective combined operation of hydroelectric plants with customers' existing steam equipment, not as the final word in a power deal but in the light of a business opportunity. Because of its contract with the Consolidated Gas, Electric Light & Power Company of Baltimore and other large consumers of energy having steam equipment, the Pennsylvania Water & Power Company has felt itself warranted in adding to the hydraulic installation at Holtwood from time to time and in utilizing more and more of the possibilities of the river, until at the present time the installed capacity is eight times the low-water flow of the river.

Both papers were discussed by A. S. Loizeaux, electrical engineer of the Consolidated Gas, Electric Light & Power Company of Baltimore.

Immediately following the afternoon session most of those in attendance visited the new Christian Street generating station of the Philadelphia Electric Company. This station, which was briefly described and illustrated in last week's issue, contains a 30,000-kw. and a 35,000-kw. turbo-generator. Facility for a minute inspection of the station was afforded by the Philadelphia Electric Company, whose staff, under W. C. L. Eglin, showed the visitors every courtesy.

Tallulah Falls Hydroelectric System

An informal dinner was served at the Hotel Normandie, after which the evening session was begun in the Engineering Building of the University of Pennsylvania. The paper of the evening, entitled "Construction Elements of the Tallulah Falls Development," was by Charles G. Adsit and W. P. Hammond. A very complete description of the Tallulah Falls hydroelectrical development was given. (See ELECTRICAL WORLD, Dec. 20 and 27, 1913.) In the paper were unit costs of the various items of construction, with the exception of land or property accounts, general engineering expenses, and various other general items incident to construction cost as a whole, which were not included. The total construction cost of the power production is given as $66.666 per kilowatt. The following table, which gives the percentage relation of various expenses on the development as a whole, might be applicable to any other development in that it does not include the cost of land or property expense:

Item	Per Cent
General construction expenditure	75.575
General engineering expense	3.078
General legal expense	1.891
Interest, bonds and advances during construction	11.315
General overhead expense	1.773
General contract expense	6.368

The power plant was operated under the construction department for about one year, and the cost of making changes or adjustment, but not the actual operation expense, is included in these figures.

A. I. E. E. Directors' Meeting

The regular monthly meeting of the board of directors of the American Institute of Electrical Engineers was held in New York on Oct. 8. The following additional committee appointments were announced: Committee on use of electricity in mines—Wilfred Sykes, chairman; iron and steel industry committee—T. E. Tynes, chairman. The report of the finance committee, submitting the annual budget covering the estimated expenditures of the Institute during the appropriation year beginning Oct. 1, 1915, amounting to $102,350, was approved, and the budget was adopted.

Upon the recommendation of the board of examiners fifty-nine associates were elected, twenty-seven students were enrolled, and two applicants were elected and nine associates transferred to the grade of member. An invitation from Lafayette College, Easton, Pa., to appoint a representative to attend the inauguration of President John Henry McCracken was referred to the president with power.

Thermal Instrument for Measuring Maximum Demand

At the regular monthy meeting of the American Institute of Electrical Engineers held in New York on Oct. 8 Paul M. Lincoln presented a paper on "Rates and Rate Making." The author contended that in order to render a customer a logical bill for electric service more information than is given by a watt-hour meter is required. The necessity of recognizing load-factor in rate schedules was emphasized, and a maximum-demand meter depending upon heat and heat storage was described. The theory of such meters was discussed and a new method of measuring power-factor and volt-amperes was disclosed. The author's ideas on the question of rates are briefly summarized as follows: (1) A logical and just rate for electric service cannot be based on kilowatt-hours alone. (2) Load-factor must be recognized in some manner in order to arrive at a logical rate. (3) In order to recognize load-factor, it is necessary to measure both kilowatt-hours and maximum demand. (4) Measurement of the demand is preferable to inferring this quantity by any indirect means. (5) Measurement of demand by heating and heat-storage devices leads to a logical result, since the limiting capacity of the apparatus for supplying the service is fixed by a law of like kind. (6) Power-factor should preferably be recognized when measuring demand since the heating capacity is limited by kilivolt-amperes, not kilowatts. (7) Devices depending on heating and heat storage which are simple, cheap and accurate can be supplied for the purpose of measuring maximum demand either in kilowatts or kilivolt-amperes or both. (8) The time period for these devices may readily be varied to cover the entire range recognized by modern practice.

The paper drew out considerable discussion. Most of it centered about that portion of the author's paper dealing with rates, and the central-station representatives in particular denied the necessity for a maximum-demand meter in determining residence rates. Written discussion was submitted by A. Dow, E. P. Roberts, F. H. Sager, J. G. DeRemer, J. E. Moultrop, H. L. Wallau, F. H. Taylor, R. A. Philip, R. A. Linquist, L. R. Lee and J. D. Mortimer. Participating in the oral discussion were W. McClellan, E. J. Cheney, P. Betts, J. W. Lieb, H. G. Stott, H. W. Pack, C. I. Hall, T. I. Jones, A. W. Burke and W. N. Polakov.

Mr. Lieb quoted statistics from a city having 100,000 customers showing that 10,000 did not use 65 cents' worth of electricity a month and 40,000 customers used less than $2.50 worth of electricity a month. Mr. Hall described a maximum-demand indicator being manufactured by the General Electric Company and Mr. Burke told of a simple device used by him in Wilmington, Del., whereby only the excess energy above a certain predetermined limit is measured. It was generally admitted by the central-station men taking part in the discussion that a low-priced maximum-demand indicator could be used by them in daily service, but not, however, on residence loads.

Meeting of Executive Committee, Commercial Section, N. E. L. A.

At a meeting of the executive committee of the Commercial Section of the National Electric Light Association held in New York Oct. 7 reports were made by the chairmen of the finance committee, publications committee, "Salesmen's Handbook" committee, committee on education of salesmen and committee on wiring. With the exception of the last-named committee, the substance of the reports was published in last week's issue. R. S. Hale, chairman of the committee on wiring, stated that the work of standardizing plugs and receptacles is progressing very well, and that he has called a meeting of the manufacturers of these appliances so that all may have the opportunity to lay anything they desire before the committee. The work on concentric wiring is also progressing, many installations having been made in various cities. President Lloyd stated that he had added an electric-range committee to the Commercial Section committee after attending the convention of the Northwest association, believing that a committee of Western members on this subject would make a very interesting report for the next convention.

New Army Field Telephone and Buzzer Devised by Signal Corps

The Signal Corps of the United States Army has invented a new camp telephone and a new service buzzer, the latter for use in connection with all kinds of lines of communication. The new camp telephone, which is now being distributed to troops, supersedes the field telephone and has been developed by the Signal Corps for use in connection with camp telephone systems. It may be installed in tents or structures, or may be used as a portable instrument for the field. It is of the local battery type. The battery employed is a small two-cell dry battery of the tubular flashlamp type. The instrument complete weighs approximately 11 lb.

The set is made as compact as possible, and is con-

USING THE NEW ARMY BUZZER IN THE FIELD

THE NEW ARMY BUZZER AND TELEPHONE IN FIELD USE—WALKING AWAY TO LAY CONDUCTOR, AND METHOD OF REELING UP WIRE—NOTE GROUND ROD BEHIND INSTRUMENT CASE

tained in a small oak case. The top consists of a metal-hinged cover with circuit diagram on the inside, and is held rigidly when closed by a spring snap which can readily be released by pressing a button. The bottom of the case is covered by a flanged piece of metal, and the case is equipped with an adjustable carrying strap. The instrument may also be operated with cover closed. This is found advantageous in inclement weather. To accomplish this there is a suitable opening for leading out the three-conductor cord to receiver and transmitter, the two latter being mounted in the form of a unit termed a hand-set.

The buzzer is strictly a portable instrument and is issued to troops in the field. It may be used as a telephone or for sending customary Morse or Continental code signals, and for that reason it is specially adapted for field use.

When it becomes impracticable to transmit messages telephonically, owing to the line becoming impaired or otherwise, the usual telegraphic signals can be transmitted and are received in distant telephone receivers in the form of a high-pitched hum somewhat similar to radiotelegraphic signals. These signals have been exchanged between two of these instruments after the line in use became severed, both the ends being slightly grounded.

The service buzzer, which is the latest approved instrument of this type of apparatus, replaces the field buzzer, the cavalry buzzer and the field artillery telephone, and hereafter will be the standard apparatus in place of that just enumerated.

Central Stations at New York Electrical Show

Among the exhibits at the Electrical Exposition and Motor Show, which closes this week at the Grand Central Palace, New York City, were a number of displays by central stations that serve the city and its suburbs.

The Edison Electric Illuminating Company of Brooklyn in an elaborate exhibit showed the industrial advantages, conveniences and attractions of Brooklyn Borough for manufacturing purposes. These advantages include an extensive water front, excellent terminal facilities, proximity to great markets, abundant labor, sanitary, well-located loft buildings at reasonable rents, and cheap electric power. To illustrate these industrial features of Brooklyn, a panoramic view in colors showing the water front was featured.

The New York Edison Company showed how the business of meeting the varied demands for electricity in a city like New York requires more than a power plant and a network of wires. The work of bureaus through which the customers of a central station may keep informed of the rapid developments in the lighting field was explained in displays, with the part played by a staff of illumination engineers, a staff of power engineers, sign experts, heating experts, commercial engineers, power-plant experts and automobile engineers.

The exhibit of the United Electric Light & Power Company was divided into three sections. One section served as the general office of the company, together with the headquarters for the Ward special electric-vehicle campaign. In the center portion of the booth a panoramic view of the Hudson River and the New York shore line from 125th Street to 207th Street, showing the Washington Heights territory with its electric lights in the background, was displayed. The third section was occupied by the United Electric Shop, fully equipped for the sale, introduction and demonstration of many useful electrical appliances.

The aim of the exhibit of the New York & Queens Electric Light & Power Company was to show what is being done and what is contemplated in the future development of the borough of Queens. The display by means of maps, charts, photographs and operating appliances described many activities in Queens. The company serves a territory covering an area of 117.36 square miles.

The Yonkers Electric Light & Power Company and the Chamber of Commerce of the City of Yonkers had an attractive display, portraying the commercial and residential advantages of the Terrace City on the Hudson. In the Chamber of Commerce section were shown statistical tables on the city's growth and opportunities. By means of a stereo-motograph, views of the city and principal buildings were displayed, and in a portion of the space were samples of the product of the Yonkers manufacturers. The other half of the booth served as a reception room for the Yonkers Electric Light & Power Company.

Demonstrations of long-distance telephone transmission of conversation and music from the Panama-Pacific Exposition at San Francisco were made in a sound-proof auditorium. This demonstration was given by the American Telephone & Telegraph Company and its associated companies representing the Bell system. The auditorium provided seats for 164 persons, each seat being equipped with two telephone receivers which were connected at regular hours with San Francisco. The program included a talking motion picture portraying the birth of the telephone. One of the most interesting features of this exhibit was the transmission of the roar of the Pacific Ocean by telephone from the Cliff House, at Seal Rocks, near San Francisco, accompanied with a motion picture of this famous California resort.

FACTS ON ELECTRICAL PROSPERITY WEEK

Increasing Enthusiasm Found in Country-Wide Plans of All Electrical Interests for the Campaign

An enthusiastic group of men gathered in the offices of the Society for Electrical Development, New York, and heard the revelation of facts, figures and promises which assure "Electrical Prosperity Week." They were members of the advisory committee and some others. Central stations, manufacturers, jobbing interests, contractors and the technical press were represented at this meeting on Oct. 7.

"Except for a part of the Southeastern section, on which we are now working, practically the entire country is supporting the movement," declared J. M. Wakeman, the general manager; and H. W. Alexander, director of publicity for the society, quoted the words in which a prominent man expressed his confidence: "I said that it couldn't be done, but it has been done."

"Be specific" is the demand upon the society now from many quarters. The United Fruit Company asks how its steamers can take part. The Western Union Telegraph Company sends to find what it can do. Organized committees in the different cities write, telegraph and telephone to see what the society can suggest to enlarge their plans. All of these requests are answered by specific advice. The United Fruit Company is told that its steamers, traveling to Central American and West Indian ports, can advertise the electrical equipment which they have on board and display significant signs. The Western Union, offering the use of its house organ, suggests displays in its offices throughout the country and inclosure of literature with its messages. Local committees learn, for instance, about the special advertising appropriation of $15,000 by the Boston Edison company and of $5,000 for a house-wiring campaign by the Brooklyn Edison company and of other similar instances.

From the call of the Western Union company suggestion arises that local managers of the telegraph and telephone companies be asked to serve on the various city committees. The New England and other telephone companies have agreed to send the society folder with all November bills. Additional telephone companies are being asked to do this.

L. D. Gibbs described the extensive plans of the Edison Electric Illuminating Company of Boston. At the suggestion of W. H. Atkins the company is considering the scheme of flood-lighting a prominent government or other building in each city and town. The idea is that the Custom House in Boston, beautiful civic groups in several communities and other prominent buildings in the forty-two cities and towns would be treated in this way. "If this is done it will be the hope," added Mr. Gibbs, "that the effect will be liked so much that flood-lighting of these buildings will be continued permanently."

"The Mayor of Philadelphia," remarked Mr. Alexander, "writes that he will have the city hall brilliantly lighted during the entire week." "Flood-lighting will be used on the capitols in Salt Lake City, Richmond, Denver and Boise for the week," added Mr. Wakeman. "Cincinnati will use powerful searchlights of red, blue, yellow and green."

M. S. Seelman, Edison Electric Illuminating Company of Brooklyn, related with much enthusiasm the excellent prospects of the house-wiring campaign for Electrical Prosperity Week. At a meeting of the Kilowatt Club, composed of employees of the company and contractors and dealers, the plan received hearty indorsement. On house wiring done or contracted for during the week a reduction in cost will be made. The Brooklyn company will also use spectacular lighting effects to draw attention to the week. "I am astonished at the country-wide results of the campaign," said Mr. Seelman. "I don't remember anything like it."

The way in which the co-operation of salesmen of the Western Electric Company is secured was described by P. L. Thomson. Every salesman is given material about the celebration and in approaching customers the first thing he talks is Electrical Prosperity Week.

"We cannot get to all towns and villages," said Mr. Wakeman; "if your salesmen are doing that, they are rendering important service."

F. R. Davis mentioned the letter issued by the General Electric Company to local managers. T. J. McManis, Edison Lamp Works, discussed the co-operation of that organization. Mr. Alexander told about the work of the Westinghouse Electric & Manufacturing Company.

Plans under consideration in various cities were mentioned, many of which will arouse unbounded public interest. Denver, Cincinnati, Pittsburgh, Chicago, Louisville, Richmond, Dayton, Cleveland, Toledo, Sandusky and the adjoining district, Portland, Ore., and other Pacific Coast cities, and groups of properties in Texas, were part of those to which special attention was drawn.

At their annual convention in San Francisco the Rotarians passed a resolution indorsing the movement and advising that every "Rotary club" in the country have a meeting in Electrical Prosperity Week. There are 17,000 Rotarians. Mr. Wakeman, in giving this information, said that these clubs will discuss electricity at every Rotarian meeting held during that week.

In the next issue of the *Exciter* Frank A. Vanderlip, Henry L. Doherty, L. A. Osborne, A. W. Burchard and others will indorse the movement.

Companies in fifteen counties in northern Ohio have engaged a publicity man to promote interest in the week.

About Nov. 10 the society will circulate new publicity material of public interest about electrical prosperity. To sustain and increase the interest as it draws toward the climax in the week itself is the object in holding material in reserve. The timely use of this, it is calculated, will directly focus public attention on the period from Nov. 29 to Dec. 4.

Thomson Electric Welding Patents Upheld

Judge Putnam of the United States Circuit Court of Appeals, Boston, Mass., on Oct. 5 delivered an opinion sustaining the Thomson Electric Welding Company of Lynn, Mass., and its agent, the Universal Electric Welding Company, New York City, in a suit against Barney & Berry, Inc., of Springfield, Mass., for infringement of patent. The case was defended by the Toledo Electric Welding Company of Toledo, Ohio, and was appealed by the Thomson company from an adverse finding in the United States District Court. The case involved an exhaustive presentation of the history and status of electric welding, with considerable expert testimony.

The opinion points out that the invention of the electric spot-welding process by Harmatta marked a great advance over the electric butt-welding process patented in 1886 and later by Prof. Elihu Thomson. The Thomson patents constitute the foundation of the art. The Harmatta patent now in suit is regarded as a new development. There have been other subsidiary inventions, as, for instance, the lap-roller process, invented also by Thomson, by which the method of uniting the overlapping edges of two sheets of metal by a lap weld was devised, and by virtue of which some other secondary inventions were

made practicable; but all of these are in different fields from the spot-welding invention under consideration. With reference to the defendant's claims based on the roller-electrode process or other processes devised for overlapping sheets the court states that it is plain that neither in its practical operation nor in its result was there any resemblance to the spot-welding process such as to require discussion. These observations apply to all those lines of defense which rest upon the attempt to compare the size of contact spaces or areas mathematically; and, further, a study of all these special defenses, which included an attempt to show priority and lack of distinction between processes, going to the proposition that spot-welding, as shown by Harmatta, was in any way anticipated, falls to pieces, "because there was nothing in them indicating an element of commercial success, and in this art, which was special and practicable, the art for rapid and inexpensive or cheap product was the first element of success." The decree of the District Court is reversed on a partial finding, since the court declares itself unacquainted with the exact proceedings of the respondents since the patent was issued. The testimony indicated that the respondents have been using an infringing machine, and the case is remanded to the lower court for further proceedings in harmony with the opinion just issued.

Statistics of Electrical Engineering Courses

Totals for Nine Years of Students in and Graduates from the Principal Technical Schools of the United States

The ELECTRICAL WORLD recently completed its ninth annual census of the college population in electrical-engineering courses and of the graduates of such courses. The results are shown herewith in tabular and graphical form. The statistics are compiled for three classes of schools—those in which the standards are very high and graduation from which is *per se* an asset to the graduate; others which are giving full electrical courses of substantial character, and those giving short or special courses for immediately practical purposes.

The ELECTRICAL WORLD undertook this work originally and has continued it because the technical schools are as much a part of the industry as are lamp factories and power plants. The industry is therefore interested to know the relation of the rate of student graduation to the condition of the industry. The faculties and administrative departments of the schools also should find such data of value because they render possible a comparison of the local registration and graduating rate with the respective averages for all institutions.

The data show conclusively that there is no definite relation between conditions in educational institutions and in the industrial world. The output of the colleges is fairly uniform, as is also the registration. This may be explained by consideration of several of the many factors contributing to the result. In the first place, the length of the usual course, four years, is sufficient to permit the averaging of the temporary influences which make for contraction and expansion. Some of these influences have a neutralizing tendency among themselves. For example, hard times involve shortage of money, but coincidently there is a shortage of positions and young men who might in normal times go to work decide to continue their studies. In the second place, the function of the technical school is not to produce engineers but rather to give a broad technical education. Hence the schools are less sensitive to the law of supply and demand than are those branches of the industry which produce a more tangible product.

This journal would appreciate from its readers statements as to the value of the statistics to them and suggestions as to how the canvass could be made more complete if the enlargement of its scope appears to be warranted.

TABLE I—STATISTICS OF POST-GRADUATE AND UNDERGRADUATE STUDENTS IN 1914 AND 1915

	Freshmen	Sophomores	Juniors	Seniors	Post-Graduates	Total Students	Graduates	Total Graduates to June
1914 First...	1,140	819	714	627	98	3,398	667	10,212
Second.	1,846	1,200	881	689	89	4,705	679	8,020
Third..	581	360	283	240	2	1,466	284	2,918
Totals.....	3,567	2,379	1,878	1,556	189	9,569	1,630	21,150
1915 First...	1,144	902	722	576	133	3,477	535	10,549
Second.	1,871	1,297	926	703	68	4,865	683	8,659
Third..	703	405	442	327	12	1,889	314	3,267
Totals.....	3,718	2,604	2,090	1,606	213	10,231	1,532	22,475

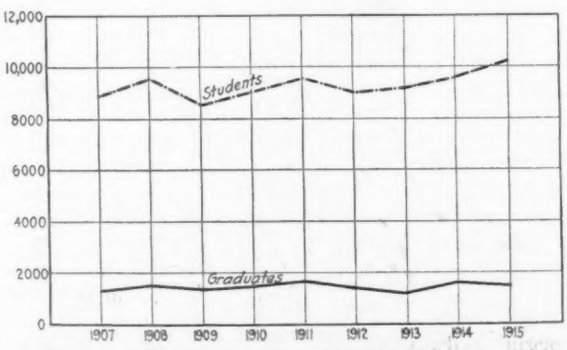
TABLE II—COMPARISON OF TOTALS FOR NINE YEARS

Year:	1907	1908	1909	1910	1911	1912	1913	1914	1915
Students.....	8,929	9,651	8,670	9,041	9,515	8,921	9,143	9,569	10,231
Graduates....	1,358	1,501	1,473	1,545	1,641	1,442	1,366	1,630	1,532

Average student registration, nine years 9296
Average number of graduates, nine years 1499
Average of positive and negative maximum departures from averages, registration and graduates ..... Less than 9 per cent

TABLE III—ELECTRICAL ENGINEERING STUDENTS AND GRADUATES

	Number of Schools	Students 1914-1915	Graduates 1915	Total Graduates to and Including 1915
Class I.....	25	3,477	535	10,549
Class II.....	70	4,865	683	8,659
Class III.....	22	1,889	314	3,267
Totals.....	117	10,231	1,532	22,475



NINE YEARS' TOTALS OF ELECTRICAL-ENGINEERING STUDENTS AND GRADUATES

Arcing Characteristics of Air-Break Switches

Arrangements of Test Circuits, Character of Tests, Operating Conclusions, and Interpretation of Oscillograph Records in Connection with High-Tension Operation

BY CHARLES E. BENNETT

THERE has been a variety of opinion and practice as regards the use of air-break switches in the circuits of transmission lines. In order to establish some facts in regard to the performance of such switches, more than 250 tests on several designs were conducted by the writer for C. O. Lenz, chief engineer of the Virginia Power Company and the Georgia Railway & Power Company, New York City, for consideration before selecting designs for the branch-circuit switching of the former company in its service to coal mines. The tests were conducted under different weather conditions, such as snowstorms, rainy and clear weather, with no wind and with wind as high as 50 miles per hour. The tests were made primarily for the purpose of studying the effect of operating air-break switches at different loads and voltages from 50,000 to 110,000,

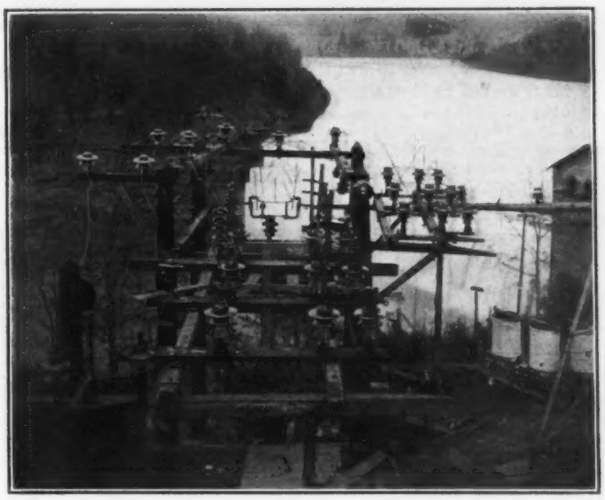


FIG. 1—STRUCTURE ON WHICH AIR-BREAK SWITCHES WERE MOUNTED FOR TEST

as compared with breaking the circuits through oil switches, and to determine the arcing characteristics of switches available for use. While five different designs of switches were used, the tests as conducted were not made to show competitive performance, the study being made to determine how different loads affect different switches rather than how different switches operated under the same loads. Of the three switches on which the largest number of tests were made, one was rated at 70,000 volts and the two others at 44,000 volts. The rating, however, was more or less arbitrary and depended simply upon the spacing between the phases and the length of the blades. These spacings were different on all of the switches so that these tests are a study in design and performance rather than of the operation of competitive switches.

The tests made may be divided into two classes. In one case a true energy load was interrupted, while in the other the charging current of about 180 miles of transmission line was handled. All of the tests were made at Gainesville, Ga., at the Dunlap station of the Georgia Railway & Power Company midway between Atlanta and Tallulah Falls. These two points are about 90 miles apart and connected by a double-circuit, 110,000-volt steel-tower transmission line. A tie switch at the Dunlap station with sectionalizing switches for the two circuits made it possible to connect the transmission line into four sections each 45 miles long. Each of these sections furnished about 7 amp. charging current at 50,000 volts, making the maximum load 28 amp. or 2400 kva. of leading power-factor. At the testing

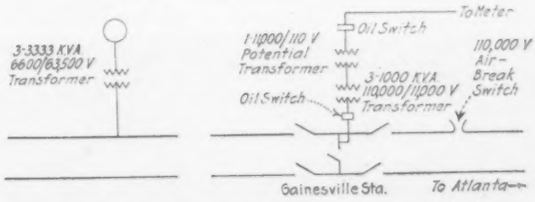


FIG. 2—CIRCUIT ARRANGEMENTS FOR 110,000-VOLT AIR-BREAK SWITCH TESTS

point four 550-kw., 440-volt, two-phase, sixty-cycle generators were available to supply a true energy load through water rheostats. The current was taken from these generators through two banks of transformers consisting of two 550-kw. units, Scott-connected and stepping the voltage up from two-phase, 440 volts, to three-phase, 50,000 volts.

For a large number of tests oscillograph records were made. There was available for this purpose a spare 50,000/440-volt, 550-kw. transformer, which made it possible to take the voltage curve of the oscillograph record from the high-tension side of the transformer. There was also placed in the circuit on the power side of the switch a 50,000 volt ten-to-one current transformer which was connected to the oscillograph for the current record. The instrument was also connected to the load side of the switch through a suitable potential transformer, but could only be used when that part of the line to which these transformers were connected furnished part of the artificial load, which was not the case in all of the tests. The circuit connections for

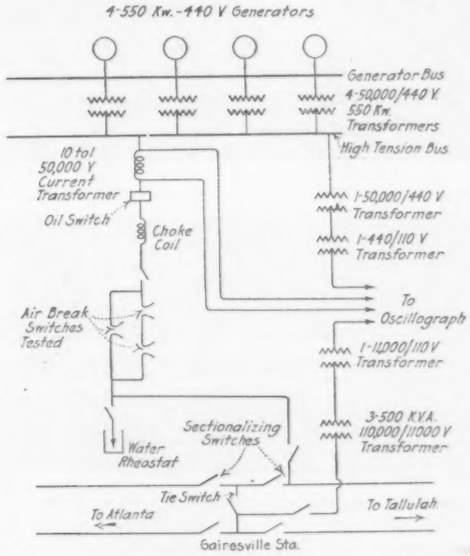
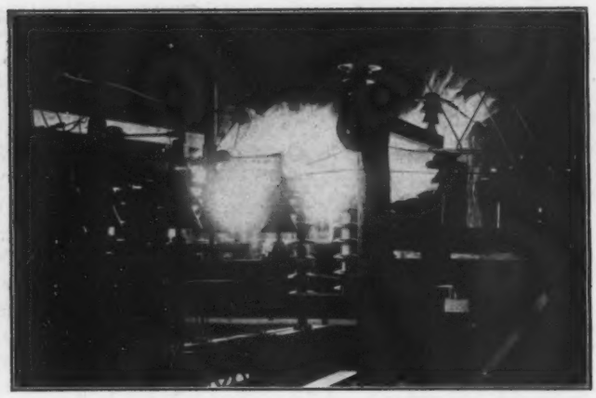


FIG. 3—CIRCUIT ARRANGEMENTS FOR 44,000-VOLT AIR-BREAK SWITCH TESTS



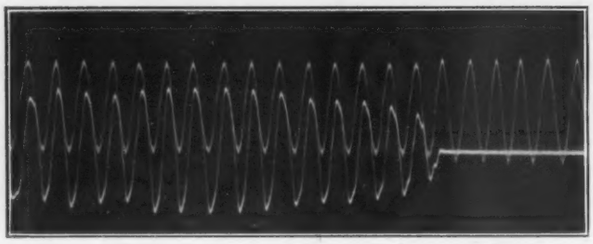
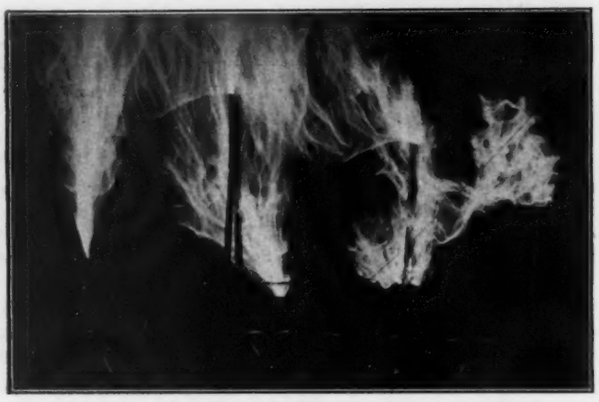


FIG. 4—BREAKING A TRUE-ENERGY LOAD OF 3000 KVA. AT 50,000 VOLTS—TIME TO BREAK ARC, THREE SECONDS

The switch was tripped and the arc extinguished itself before rising up the horns. The upper curve of the oscillograph record shows voltage on power side of the switch, and the lower curve current on the same side.



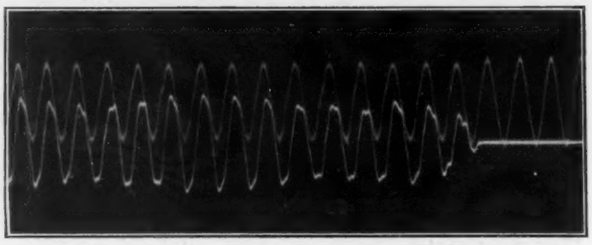
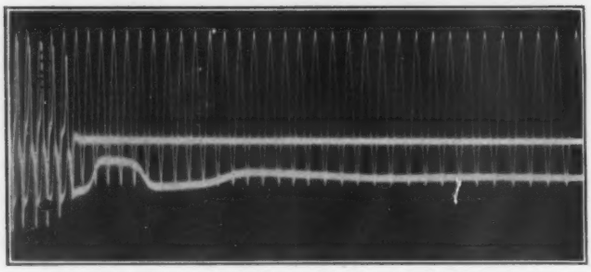
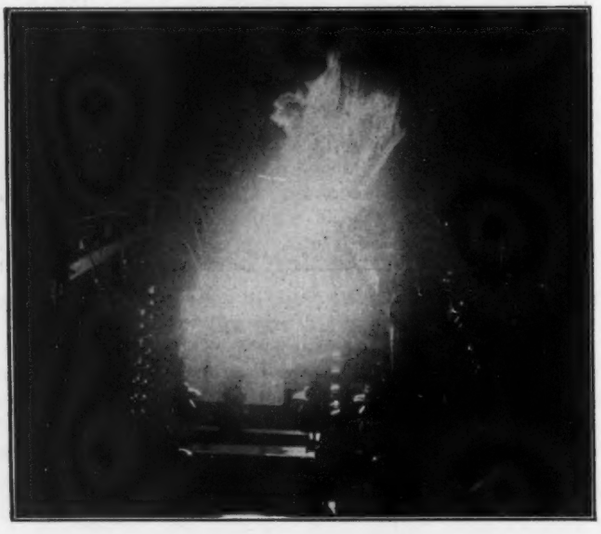
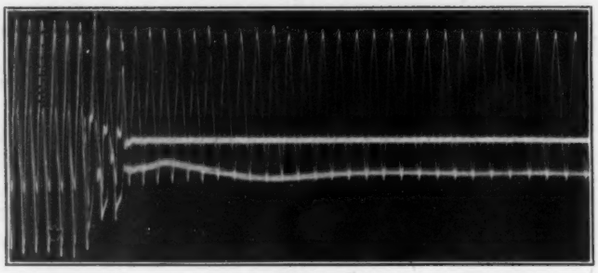


FIG. 5—BREAKING A TRUE-ENERGY LOAD OF 3500 KVA. AT 50,000 VOLTS—TIME TO BREAK ARC, THREE SECONDS

The switch was tripped and the arc extinguished itself after rising to the top of the horns. The oscillograph curves are for the same connections as in Fig. 4.

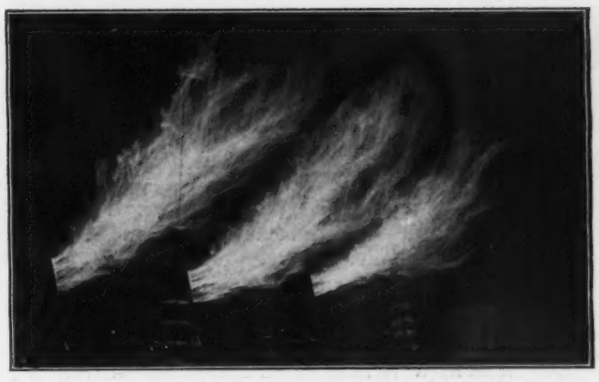


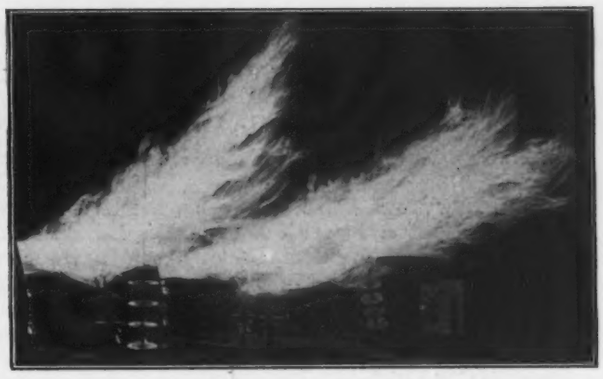




FIGS. 6 AND 7—BREAKING CHARGING-CURRENT LOADS OF 1200 KVA. AT 110,000 VOLTS WITH TWO DIFFERENT SWITCHES—TIME TO BREAK ARC, ABOUT NINE SECONDS

In Fig. 6 the arcs broke successfully after the switch was opened. In Fig. 7 the wind blew arcs across phases and short-circuited the line. The upper curve of the oscillograph record shows voltage, the middle curve current on power side of the switch, and the bottom curve voltage on the load side.





FIGS. 8 AND 9—BREAKING ABOUT 2600-KVA. LOAD AT 112,000 VOLTS, SHOWING THE EFFECT OF WIND

In the case of Fig. 8 the arcs were about 15 ft. long and blown sidewise by the wind, breaking successfully. In the case of Fig. 9 the arcs were about 12 ft. long and held to the lower part of the switch blades, breaking before rising up the horns. Phases were separated 8 ft. and 10 ft.

these tests are shown in Fig. 3. In Fig. 2 are shown the connections for the 110,000-volt tests. In these cases energy was taken from one 10,000-kw. generator at the Tallulah Falls hydroelectric plant and stepped up through one bank of 3333-kva. transformers delta-Y connected. At these higher voltages the switches were opened under voltages varying from 65,000 to 120,000, with a charging current varying from 18 amp. to 20 amp. This corresponded to a load of from 2000 kva. to 6000 kva., only half of which was interrupted on account of the location of the switch at the midpoint of the line as shown in Fig. 2.

Operating Conclusions

It was found that the maximum time required to break the arc in the 50,000-volt tests was twenty-five seconds, minimum time two seconds, and average time six seconds. This time depended more upon the weather conditions than on the kva. load on the lines, the velocity of the wind being the most important factor. The maximum time required to break the arc at 110,000 volts was sixteen seconds, minimum time three seconds, and average seven seconds. This seems to indicate that the air-break switch requires about 120 to 1500 cycles in which to interrupt the circuit, while the oil-break switch may accomplish the same result in a few cycles. This time element in the case of the air-break switch produces an effect in the line similar to a series of light hammer blows. These blows, while not so violent as the one caused by an oil switch, probably have a damaging effect on insulation. It was found that a true energy load was more easily interrupted than a charging current of the same kva. value under the same weather conditions. Under light loads, high winds of about 50 miles per hour materially aided in breaking the arcs by sweeping them from the horns. With heavier loads, however, or lower wind velocities the arcs would lap over the phases and trip the breakers at the power house before they would let loose from the horns or blades.

From the results of the tests the writer is of the opinion that none of the switches used was sufficiently spaced, and that the minimum distance between the phases for 44,000 volts should be at least 7 ft. and for higher voltages proportioned accordingly. The 70,000-volt switch used was spaced 6 ft. between phases and the 44,000-volt switches 4 ft. It is also the opinion of the writer that the proper design of an air-break switch should provide a mechanical movement when opening the switch such that it will aid the arcs in ascending the horns. The theory that the heat of the arc alone will carry it up the horns is doubtless well founded, but this force is only great enough to accomplish this result when the air is perfectly still. With the slightest wind blowing, the arcs are blown sidewise, and the tendency of the arc to rise is more or less counteracted by this horizontal wind pressure. If, however, the mechanical movement is such as to draw the arcs up the horns, the tendency to rise is increased and it is much easier then to break the arc. The arc appears to be an uncontrollable feather-like medium, and but a slight wind will blow it 8 ft. or 10 ft. horizontally. This is clearly shown in Figs. 8 and 9.

Interpretation of Oscillograph Records

From the oscillograph records made and shown in the accompanying illustrations it will be noted that there is a considerable disturbance caused on the line evidently due to the charging and discharging of the line as a condenser. The harmonics are set up on the regular sine wave, but, owing to the high frequency, oscillations are not clearly shown by the oscillograph. This is probably due to the fact that the transformers used in stepping down the voltage for the instrument absorbed these surges. In order to get a better check on the voltage rise on the load side of the switch, a needle spark-gap was connected and set at 5, 6, 7 and 8 in., or for about 63, 72, 80 and 87 kv. The circuit was broken under different loads with the different types of switches, and the points were set at these distances when the maximum sparking distance was noted. The circuit was then interrupted with an oil switch, under similar conditions and loads, and it was found that the sparking distance was greater than with an oil switch under the same load. This is contrary to some opinions on the subject.

This experiment seems to show that the tendency for the lines to spill over the insulators when the system is interrupted with an oil switch is greater than when the air-break switch is used. If air-break switches are to be used to sectionalize only short lines, or for cutting in and out a bank of transformers occasionally, or for use in emergency, the writer is of the opinion that there will be no dangerous effects due to their use. Where frequent switching is necessary, the oil switch is undoubtedly much safer.

The chief difficulty in the use of air-break switches is the large amount of space necessary for their construction. The different phases must be widely separated and great care exercised in wiring up the switches so that the arcs of one phase cannot blow against the leads to some other phase and thus short-circuit the line. In some cases the arc is blown downward, and this means that the switches must be well insulated from supporting steel work a distance sufficient to keep the arc from lapping and thus grounding the line.

Selling Vehicles on the Installment Plan

An $875 Electric Delivery Wagon for the Grocer and Butcher, with Battery Rental Service at $10.50 per Month

THE New York Edison Company, the United Electric Light & Power Company, the Edison Electric Illuminating Company of Brooklyn, the New York & Queens Electric Light & Power Company, the Flatbush Gas Company and the Public Service Electric Company of New Jersey are at present actively engaged in a campaign having for its object the wider application of electric vehicles in their respective territories.

As announced in these columns Sept. 25, a plan has been inaugurated by the Ward Motor Vehicle Company of New York whereby a dependable electric delivery wagon may be purchased in New York City and New Jersey for $875 on a deferred-payment plan covering one year. This price includes also the first year's rental of an Edison storage battery.

Vehicle for the Butcher and Baker

The vehicle, which is shown herewith, has a normal loading capacity of 750 lb. It is equipped with a heavy-duty series-wound Westinghouse motor, driving through a propeller shaft to the rear axle, and has a sixty-five-cell G-4 Edison storage battery. The battery is contained in a box under the driver's seat. At a speed of approximately 10 miles per hour, the radius of action of the vehicle ranges from 35 to 45 miles per charge. There are semi-elliptical front and rear springs and the front axle is of drop-forged steel with Timken bearings. The rear axle is a pressed-steel housing on helical gears with Timken bearings. Four speeds ahead and two on reverse are provided by the continuous-torque controller.

It is the intention of the vehicle manufacturer, backed by the sales organization of the central-station companies mentioned, to interest bakers, grocers, butchers, laundries, etc., in this vehicle. Hence the builder of the vehicle has had a rectifier developed which gives a tapering charge so that the battery cannot be abused. By the terms of payment the customer pays $44.50 on the signing of his contract, $296 on the delivery of the vehicle, and the balance in twelve equal monthly installments of $44.50. These latter payments are arranged in the form of notes, bearing interest at the rate of 6 per cent per annum. By this means the burden carried by the vehicle manufacturer is lightened considerably, the paper being available for discount if so desired.

The battery which forms part of the vehicle's equipment is, as already stated, of the sixty-five-cell G-4 type. It has a rating of 100 amp.-hr. and a normal charge and discharge of 30 amp. The average weight per cell, including the tray, is 12.5 lb.

After the completion of the first year the owner of the vehicle pays the Edison Storage Battery Company a monthly battery rental of $10.50, provided that the odometer does not record more than 625 miles in that month. For all excess mileage over 625 there is an extra charge of 1¾ cents per mile. Vehicles of the type offered have been in use for some time.

THIS 750-LB. ELECTRIC DELIVERY WAGON IS SOLD FOR $875 ON A TWELVE-INSTALLMENT PAYMENT PLAN, WITH BATTERY RENTAL AT $10.50 PER MONTH

New York to Cleveland by Electric Truck

At present a vehicle of this type is making a run from New York to Cleveland. This vehicle started from the Grand Central Palace, New York, at 2.30 p. m. Oct. 6, coincidently with the opening of the annual Electrical Exposition and Motor Show, and reached Peekskill, N. Y., the same evening. The next day it ran through to Albany, N. Y. According to the report of the expert of the New York Electric Vehicle Dealers' Association who is accompanying the vehicle as official observer, 111 amp.-hr. were consumed in making the run from the Grand Central Palace to Peekskill, a distance of 45 miles. At Ossining the battery was given a boost of 80 amp.-hr. for one hour because it was found necessary to make a long detour from the main road in order to reach Peekskill, this detour including bad roads and heavy grades. On the road from Peekskill to Albany the vehicle, which was carrying its rated capacity of 750 lb., stopped at Poughkeepsie to receive a boosting charge.

As yet the campaign started by the sales organizations of the central stations of New York City and New Jersey have not been under way long enough to show results, but it is expected that by the time the offer expires—that is, Oct. 31—a large number of vehicles will have been sold. At present they are selling at the rate of three a day. Each of the central-station companies has a large number of electric-vehicle "prospects" whom they feel certain will be interested in the proposition. There are a large number of the vehicles already in operation in the territory of the Public Service Electric Company of New Jersey which were put out prior to the present campaign. In that territory the company has found a number of customers who prefer to pay for their vehicles outright. It is expected, however, that the deferred-payment plan for the vehicle itself and the monthly battery payment will be greatly instrumental in successful sale of a large number of the vehicles.

A fund of $10,000 has been pledged by the vehicle maker and the central-station companies for advertising the offer in the press of New York City and in the territory of the Public Service Electric Company of New Jersey. Cars for demonstrating purposes are available to the central stations on request, and in addition there is an exhibit at the Electrical Exposition and Motor Show in New York City.

Trigonometric Expressions for the Phenomena Occurring in Long-Distance Transmission Lines

BY V. KARAPETOFF[1]

The author of this article presents a real addition to mathematical interpretations of the phenomena of transmission lines. He shows how the equations discussed may be practically applied to investigate the effect of frequency upon the velocity of propagation of alternating currents, power dissipation along the line, and in studying the transmission of speech without distortion. An approximate formula for determining the voltage rise at the receiving end of a transmission line will be given next week for the use of those who are not familiar with the complex quantities of the equations given.

THE purpose of this article is to give some practical applications of simple trigonometric expressions for the rate of variation of the phase and of the amplitude of the voltage along a transmission line or a cable. These expressions are as accurate as the formulas found in most standard works on the subject, but are much more convenient in application, the simplification being due to the introduction of certain auxiliary angles. While in principle these formulas are not new, the practical applications given below are of sufficient interest to warrant giving a brief proof of the formulas and introducing certain definitions which are convenient in application.

Let a long power-transmission line, a telephone line, a telegraph line, or a cable, have the following constants per unit length of the loop: resistance r, inductance L, capacity C and leakage conductance g. Let an alternating voltage $\dot{E}_1$ of a frequency f be applied at one end of the line and let the other end of the line be loaded on some given impedance. The voltage at each point of the line is an alternating one (neglecting the original transient term), but differs from $\dot{E}_1$ in phase and in amplitude.

The general differential equations of propagation of sinusoidal currents and voltages along conductors with distributed properties are:[2]

$$\frac{d^2\dot{I}}{ds^2} = YZ\dot{I} \tag{1}$$

$$\frac{d^2\dot{E}}{ds^2} = YZ\dot{E} \tag{2}$$

In these expressions $\dot{E}$ and $\dot{I}$ are the vectors of voltage and of current at a point distant s from the receiving end of the line. Z and Y are the series impedance and the shunted admittance of the line per unit length ex-expressed as complex numbers, or

$$Y = g + jb = g + j2\pi fC \tag{3}$$

$$Z = r + jx = r + j2\pi fL \tag{4}$$

The solution of equations (1) and (2) is of the form

$$\dot{I} = \dot{A}_1\varepsilon^{ms} - \dot{A}_2\varepsilon^{-ms} \tag{5}$$

$$\dot{E} = Z_0[\dot{A}_1\varepsilon^{ms} + \dot{A}_2\varepsilon^{-ms}] \tag{6}$$

where $\dot{A}_1$ and $\dot{A}_2$ are two constants of integration determined by the given conditions at one or two points of the line, ε is the base of the natural logarithms, and the quantities m and Z_0 have the following values:

$$m = \sqrt{YZ} \tag{7}$$

$$Z_0 = \sqrt{\frac{Z}{Y}} \tag{8}$$

The complex quantity m is called the propagation constant of the line; Z_0 is known as the initial sending end impedance of the line.[3]

When the current $\dot{I}_2$ and the voltage $\dot{E}_2$ at the receiving end ($s = 0$) are given, equations (5) and (6) become

$$\dot{I} = \dot{I}_2\frac{1}{2}(\varepsilon^{ms} + \varepsilon^{-ms}) + \left(\frac{\dot{E}_2}{Z_0}\right)\frac{1}{2}(\varepsilon^{ms} - \varepsilon^{-ms}) \tag{9}$$

$$\dot{E} = \dot{E}_2\frac{1}{2}(\varepsilon^{ms} + \varepsilon^{-ms}) + (\dot{I}_2Z_0)\frac{1}{2}(\varepsilon^{ms} - \varepsilon^{-ms}) \tag{10}$$

or, in terms of the hyperbolic functions of the complex angle ms,

$$\dot{I} = \dot{I}_2\cosh ms + \frac{\dot{E}_2}{Z_0}\sinh ms \tag{11}$$

$$\dot{E} = \dot{E}_2\cosh ms + (\dot{I}_2Z_0)\sinh ms \tag{12}$$

As stated before, m and Z_0 are complex quantities determined by the impedance Z and the admittance Y for unit length of the line. It will be seen from equations (9) and (10) that the performance of the line depends upon the constants m and Z_0, so that it is important to express m and Z_0 in a simple manner through the given constants r, x, g and b.

We have

$$m = \sqrt{YZ} = \alpha + j\beta \tag{13}$$

$$Z_0 = \sqrt{\frac{Z}{Y}} = r_0 + jx_0 \tag{14}$$

where α and β are certain numerics per unit length, and r_0 and x_0 are a fictitious resistance and reactance per unit length respectively. Substituting in these equations the values of Y and Z from equations (3) and (4) and separating the real and the imaginary parts, the four constants α, β, r_0 and x_0 are readily determined. However, the expressions so obtained are somewhat complicated, and are not convenient either for numerical computations, or for a general investigation as to the effect of the relative value of each factor. For instance, the following expressions are obtained for α and β:[4]

$$\alpha = \sqrt{\frac{1}{2}\left\{\sqrt{(r^2 + x^2)\,(g^2 + b^2)} + (gr - xb)\right\}} \tag{15}$$

$$\beta = \sqrt{\frac{1}{2}\left\{\sqrt{(r^2 + x^2)\,(g^2 + b^2)} - (gr - xb)\right\}} \tag{16}$$

[1] Professor of electrical engineering, Cornell University.

[2] Heaviside, O., "Electromagnetic Theory," London, 1894, Vol. I, p. 450; Fleming, J. A., "The Propagation of Electric Currents in Telephone and Telegraph Conductors," London, 1911, p. 68; Steinmetz, C. P., "Transient Electric Phenomena and Oscillations," New York, 1909, p. 285; Karapetoff, V., "The Electric Circuit," New York, 1912, p. 209.

[3] Fleming, ibid., p. 72. Some authors call Z_0 the apparent surge impedance.

[4] Steinmetz, C. P., "Transient Phenomena," p. 286; Fleming, J. A., "Propagation of Currents," p. 69; Franklin, W. S., "Electric Waves," p. 144.

It is preferable to express Y and Z in a trigonometric form, namely,

$$Y = y(\cos\psi + j\sin\psi) = ye^{j\psi} \quad (17)$$

$$Z = z(\cos\varphi + j\sin\varphi) = ze^{j\phi} \quad (18)$$

where y and z are the numerical values of shunted admittance and of series impedance per unit length, and φ and ψ are the corresponding phase displacement angles.[5] Or, by comparison with equations (3) and (4),

$$r = z\cos\varphi \quad (19)$$

$$x = z\sin\varphi \quad (20)$$

$$g = y\cos\psi \quad (21)$$

$$b = y\sin\psi \quad (22)$$

Substitution of the exponential values of Y and Z from equations (17) and (18) into equations (13) and (14) gives

$$m = yz\cdot\varepsilon^{j\frac{1}{2}(\phi+\psi)} = \sqrt{yz}\left[\cos\frac{1}{2}(\varphi+\psi) + j\sin\frac{1}{2}(\varphi+\psi)\right] \quad (23)$$

$$Z_0 = \sqrt{\frac{z}{y}}\cdot\varepsilon^{j\frac{1}{2}(\phi-\psi)} = \sqrt{\frac{z}{y}}\left[\cos\frac{1}{2}(\varphi-\psi) + j\sin\frac{1}{2}(\varphi-\psi)\right] \quad (23a)$$

The form of these equations[6] suggests the use of the following two angles:

$$\tau = \frac{1}{2}\pi - \frac{1}{2}(\varphi+\psi) \quad (24)$$

$$\tau_0 = \frac{1}{2}(\varphi-\psi) \quad (24a)$$

The angle τ may be named the imperfection angle of the line, and angle τ_0 the initial sending end phase angle, or the surge phase angle. In a line devoid of resistance and leakage $\varphi = \psi = 90$ deg., and $\tau = \tau_0 = 0$. Comparison with equations (13) and (14) gives the following simple expressions for the constants in question:

Attenuation constant $\alpha = \sqrt{yz}\cos\frac{1}{2}(\varphi+\psi)$

$$= \sqrt{yz}\sin\tau \quad (25)$$

Wave-length constant $\beta = \sqrt{yz}\sin\frac{1}{2}(\varphi+\psi)$

$$= \sqrt{yz}\cos\tau \quad (26)$$

Initial sending end resistance r_0

$$= \sqrt{\frac{z}{y}}\cos\frac{1}{2}(\varphi-\psi) = \sqrt{\frac{z}{y}}\cos\tau_0 \quad (27)$$

Initial sending end reactance x_0

$$= \sqrt{\frac{z}{y}}\sin\frac{1}{2}(\varphi-\psi) = \sqrt{\frac{z}{y}}\sin\tau_0 \quad (27a)$$

Initial sending end impedance $z_0 = \sqrt{\frac{z}{y}}$ (28)

A comparison of equations (25) and (26) shows that the tangent of the line imperfection angle τ is equal to the ratio of α to β, or

$$\tan\tau = \frac{\alpha}{\beta} \quad (28a)$$

Since the four constants r, x, g and b of the line are supposed to be given, the four constants y, z, φ and ψ are easily determined from the following equations:

$$\tan\varphi = \frac{x}{r} \quad (29)$$

$$\tan\psi = \frac{b}{g} \quad (30)$$

$$z = \frac{x}{\sin\varphi} \quad (31)$$

$$y = \frac{b}{\sin\psi} \quad (32)$$

Or, in place of the last two equations, the following two may be used:

$$z = \frac{r}{\cos\varphi} \quad (33)$$

$$y = \frac{g}{\cos\psi} \quad (34)$$

Therefore all the quantities on the right-hand side of equations (25) to (28) are known, and the values of α, β, r_0 and x_0 are easily computed. Moreover, the introduction of the angles φ and ψ gives another insight into the phenomena themselves. Some practical applications of the foregoing equations are considered below.

1.—The Effect of the Frequency Upon the Attenuation Constant and Upon the Velocity of Propagation of Alternating Currents

The velocity of propagation of electric waves along ideal conductors is theoretically equal to the velocity of light, that is, when the resistance r and the leakage g are assumed to be negligibly small. In actual lines, however, the velocity of propagation of telephone currents is considerably below that of the light and depends upon the frequency f, the resistance r and the leakage g. For a given line, the lower the frequency the lower is the velocity of propagation, and the lower is the rate at which the amplitude of the wave is degraded or attenuated along the line. These results may be deduced from the foregoing expressions for α and β as follows:

Substitution of the values of y and z from equations (33) and (34) into equation (25) gives

$$\alpha = \sqrt{rg}\cdot\frac{\cos\frac{1}{2}(\varphi+\psi)}{\sqrt{\cos\varphi\cos\psi}} \quad (35)$$

In this expression the angles φ and ψ are functions of the frequency f, according to the well-known relations

$$\tan\varphi = \frac{x}{r} = \frac{2\pi fL}{r} \quad (36)$$

$$\tan\psi = \frac{b}{g} = \frac{2\pi fC}{g} \quad (37)$$

In order to determine whether α increases or decreases with f, form the first derivative of α with respect to f. The work of actual differentiation is much simplified if a derivative is taken of α^2 rather than of α itself. This gives

$$\frac{d}{df}(\alpha^2) = \frac{d}{d\varphi}(\alpha^2)\frac{d\varphi}{df} + \frac{d}{d\psi}(\alpha^2)\frac{d\psi}{df} \quad (38)$$

But

$$\alpha^2 = rg\cdot\frac{\cos^2\frac{1}{2}(\varphi+\psi)}{\cos\varphi\cos\psi} = \frac{1}{2}rg\cdot\frac{1+\cos(\varphi+\psi)}{\cos\varphi\cos\psi}.$$

$$\frac{d}{d\varphi}(\alpha^2) = \frac{1}{2}rg\cdot\frac{\sin\varphi-\sin\psi}{\cos^2\varphi\cos\psi};$$

$$\frac{d}{d\psi}(\alpha^2) = \frac{1}{2}rg\cdot\frac{\sin\psi-\sin\varphi}{\cos^2\psi\cos\varphi}.$$

Differentiation of equation (36) gives

$$\sec^2\varphi\cdot\frac{d\varphi}{df} = \frac{2\pi L}{r} = \frac{2\pi fL}{rf} = \frac{1}{f}\tan\varphi$$

or

[5] For trigonometric and exponential expressions of impedance and admittance see, for instance, Karapetoff, V., "The Electric Circuit," New York, 1912, pp. 68, 77, 93 and 97.

[6] The angles $\frac{1}{2}(\phi+\psi)$ and $\frac{1}{2}(\phi-\psi)$ have been previously used by Dr. Harold Pender in his article entitled "Complete Solution of Transmission Line with Distributed Capacity and Leakage," ELECTRICAL WORLD, Vol. 54 (1909), p. 90. See also H. Pender and H. F. Thomson, "The Mechanical and Electric Characteristics of Transmission Lines," *Trans. A. I. E. E.*, Vol. 30 (1911), p. 2266.

$$\frac{d}{df} = \frac{1}{f}\sin\varphi\cos\varphi$$

By analogy, from equation (37),

$$\frac{d\psi}{df} = \frac{1}{f}\sin\psi\cos\psi.$$

Substitution of the values of these four derivatives into equation (38) gives, after simplification,

$$\frac{d}{df}(\alpha^2) = \frac{1}{2}rg\frac{(\sin\varphi - \sin\psi)^2}{f\cos\varphi\cos\psi} \qquad (39)$$

All the quantities which enter in this expression are essentially positive, so that $\frac{d}{df}(\alpha^2)$ is a positive quantity, and therefore the attenuation constant α increases with the frequency. In other words, currents of lower frequency are attenuated less (their amplitude is reduced less per unit length of the conductor) than currents of higher frequencies.

Similarly, substitution of the values of y and z from equations (31) and (32) into equation (26) gives

$$\beta = \sqrt{bx}\cdot\frac{\sin\frac{1}{2}(\varphi+\psi)}{\sqrt{\sin\varphi\sin\psi}} = 2\pi f\sqrt{CL}\,\frac{\sin\frac{1}{2}(\varphi+\psi)}{\sqrt{\sin\varphi\sin\psi}} \qquad (40)$$

But, from the method of derivation, β is the angle by which the phase of the line voltage changes per unit length of the conductor. Consequently, the wave-length

$$\lambda = \frac{2\pi}{\beta} \qquad (41)$$

and the velocity of propagation

$$v = f\lambda = \frac{2\pi f}{\beta} \qquad (42)$$

Substitution in this expression of the value of β from equation (40) gives

$$v = \frac{1}{\sqrt{CL}}\cdot\frac{\sqrt{\sin\varphi\sin\psi}}{\sin\frac{1}{2}(\varphi+\psi)} \qquad (43)$$

By a method entirely analogous to that given for α above, one can prove that $\frac{d}{df}(v^2)$ is always positive, so that high-frequency currents are propagated more rapidly than low-frequency currents.

Any one who would try to prove these statements from the usual expressions (15) and (16) for α and β would find the task rather involved, and would see at once the superiority of the trigonometric expressions (25) and (26), or of (35), (40) and (43).[7]

2.—Power Dissipation Along the Line

Electric power is consumed along the line partly in the series resistance r, partly in the shunted conductance g. It is of interest to derive and to analyze expressions for this loss of power. Let the effective value of the line current at some point of the line be I, and the effective value of the line voltage at the same point E. Then the average power consumed in line resistance on an infinitesimal length ds is

$$dP_r = I^2 r ds,$$

or the average rate of power dissipation in the series resistance, per unit length of the line, is

$$\frac{dP_r}{ds} = I^2 r \qquad (44)$$

Similarly, the average rate of power dissipation in the shunted conductance, per unit length of the line, is

$$\frac{dP_g}{ds} = E^2 g \qquad (45)$$

In these formulas I^2 and E^2 can be expressed through the quantities which enter in equations (5) and (6). These expressions are of the form

$$\underline{I} = i + ji' \text{ and } \underline{E} = e + je',$$

so that

$$I^2 = i^2 + (i')^2 \text{ and } E^2 = e^2 + (e')^2 \qquad (46)$$

Let the constants of integration, $\underline{A}_1$ and $\underline{A}_2$, which have the physical dimension of a current, be expressed in the form

$$\underline{A}_1 = A_1\varepsilon^{j\theta_1} \text{ and } \underline{A}_2 = A_2\varepsilon^{j\theta_2}, \qquad (47)$$

where θ_1 and θ_2 are the corresponding phase angles. Then, using the value of m from equation (13), equation (5) becomes

$$\underline{I} = A_1\varepsilon^{\alpha s + j(\beta s + \theta_1)} - A_2\varepsilon^{-\alpha s - j(\beta s - \theta_2)} \qquad (48)$$

Separating the real and the imaginary parts gives

$$\underline{I} = [A_1\varepsilon^{\alpha s}\cos(\beta s + \theta_1) - A_2\varepsilon^{-\alpha s}\cos(\beta s - \theta_2)] + j[A_1\varepsilon^{\alpha s}\sin(\beta s + \theta_1) + A_2\varepsilon^{-\alpha s}\sin(\beta s - \theta_2)] \qquad (49)$$

Consequently, according to equations (44) and (46),

$$\frac{dP_r}{ds} = rA_1^2\varepsilon^{2\alpha s} + rA_2^2\varepsilon^{-2\alpha s} - 2rA_1A_2\cos(2\beta s + \theta_1 - \theta_2) \qquad (50)$$

By analogy, from equations (6), (45) and (46),

$$\frac{dP_g}{ds} = gz_0^2A_1^2\varepsilon^{2\alpha s} + gz_0^2A_2^2\varepsilon^{-2\alpha s} + 2gz_0^2A_1A_2\cos(2\beta s + \theta_1 - \theta_2) \qquad (51)$$

A somewhat better comparison between the values of power loss in r and g is afforded by the expressions of power loss over a quarter wave-length. Take a point on the line at a distance s_1 from the receiver end such that

$$2\beta s_1 + \theta_1 - \theta_2 = k\pi,$$

where k is any positive integer, and another point at a distance s_2 for which

$$2\beta s_2 + \theta_1 - \theta_2 = (k+1)\pi.$$

The distance between these points is

$$s_2 - s_1 = \frac{\pi}{2\beta}$$

or, using the expression for β from equation (41),

$$s_2 - s_1 = \frac{1}{4}\lambda \qquad (52)$$

Integrating equations (50) and (51) between the limits s_1 and s_2, and remembering that for a variable angle δ the integral of $\cos\delta$ between $\delta = k\pi$ and $\delta = (k+1)\pi$ is identically equal to zero, we obtain

$$P_{r,\lambda} = \frac{r}{2\alpha}\cdot[A_1^2(\varepsilon^{2\alpha s_2} - \varepsilon^{2\alpha s_1}) + A_2^2(\varepsilon^{-2\alpha s_1} - \varepsilon^{-2\alpha s_2})] \qquad (53)$$

$$P_{g,\lambda} = \frac{gz_0^2}{2\alpha}\cdot[A_1^2(\varepsilon^{2\alpha s_2} - \varepsilon^{2\alpha s_1}) + A_2^2(\varepsilon^{-2\alpha s_1} - \varepsilon^{-2\alpha s_2})] \qquad (54)$$

The expressions in the brackets are identical, so that

$$P_{r,\lambda} \gtrless P_{g,\lambda} \qquad (55)$$

according to whether

$$r \gtrless gz_0^2.$$

Using the value of z_0 from equation (28), and substituting for y and z their expressions from equations (33) and (34), the foregoing inequality becomes

$$r \gtrless r\frac{\cos\psi}{\cos\varphi},$$

or, finally,

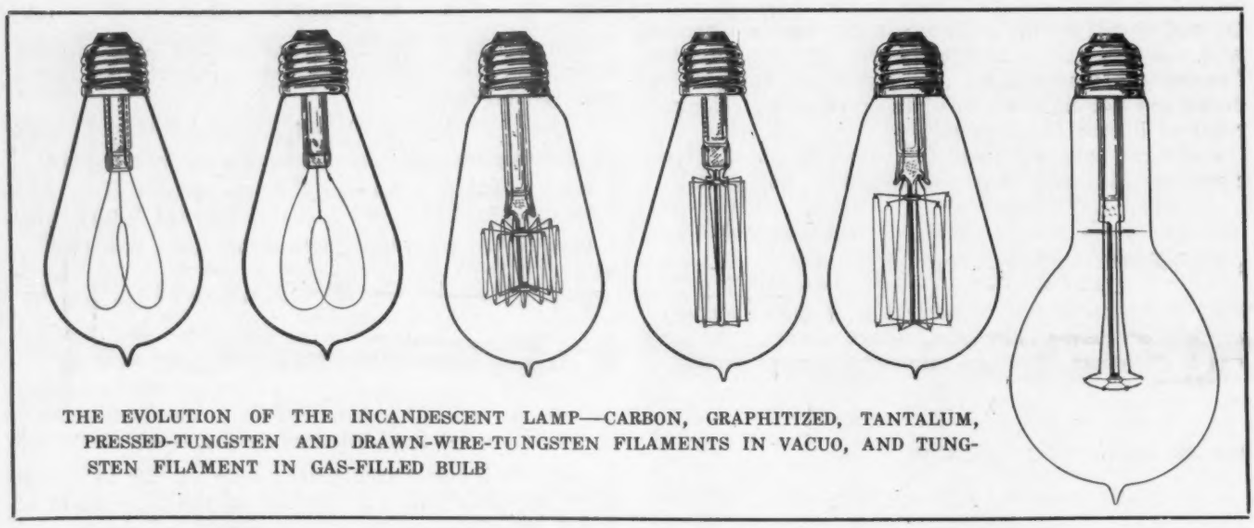
[7] Fleming, ibid., p. 77, states that "it is easily seen" that α and v increase with the frequency, but gives no general proof, except a numerical example in which he assumes $g = 0$. Moreover, he qualifies his statement by the condition that $rC > gL$. It will be seen from the foregoing discussion that the limitation is not necessary.

$$\varphi \lesseqgtr \psi \qquad (56)$$

In other words, the Joulean loss of power in the line conductors per quarter wave-length is greater or smaller than the loss of power due to imperfect insulation on the same length according to whether the series impedance angle φ is smaller or greater than the shunted admittance angle ψ.

It will be shown that speech transmission is the better the nearer the angles φ and ψ are equal to each other. In practice, ψ is much greater than φ, and the power loss in conductors is much higher than that in the imperfect insulation. For this reason, making the insulation worse sometimes improves the distinctness of the transmitted speech, though, of course, the intensity of the sound is reduced. The reason is that with a perfect insulation $\psi = 90$ deg., and as the insulation loss is increased, ψ becomes more nearly equal to φ, and the loss $P_{g,\frac{1}{4}\lambda}$ approaches $P_{2,\frac{1}{4}\lambda}$.

The concluding part of this article, to be printed next week, will cover "distortionless telephone line," "voltage rise at the receiver end," and "quarter-wave-length line."



THE EVOLUTION OF THE INCANDESCENT LAMP—CARBON, GRAPHITIZED, TANTALUM, PRESSED-TUNGSTEN AND DRAWN-WIRE-TUNGSTEN FILAMENTS IN VACUO, AND TUNGSTEN FILAMENT IN GAS-FILLED BULB

Thirty-five Years of Lamp Sales

Statistics on the Growth of Incandescent-Lamp Production Since Edison Produced First Commercial Filament Thirty-six Years Ago Next Thursday

REGULAR manufacture of the electric incandescent lamp began at Menlo Park, N. J., in 1880—during which year 25,000 lamps were made. In the following year the production was increased to 30,000 lamps, most of the output being in the 16-cp. size. By 1913, thirty-two years later, the output of incandescent lamps in the United States had reached the high mark of over 80,000,000. The rate at which the output of lamps has increased since Edison first put his lamp on the market is shown graphically on page 861. For the period from 1881 to 1904 no accurate data on the output of lamps are obtainable. In comparing different types of lamps the year 1907 is chosen as the beginning, since in that year the carbon-lamp output reached its maximum, a total of 48,800,000. Since then the demand for carbon lamps has been steadily dropping off, until in 1914 the output was but 4,500,000—less than 10 per cent of the production of seven years before.

The graphitized-filament lamp which was introduced in 1906 had for seven years a steadily increasing output, reaching a maximum in 1913 of 28,705,000. In 1914, however, the output of this lamp dropped to 16,114,000. The tantalum lamp enjoyed but a brief commercial existence. It first appeared in 1906, in which year 200,000 were manufactured. In 1910 the output was 2,433,000, the largest for any one year. The lamp last appeared on any scale in 1912, when the sales had dropped to 658,000.

In 1907, the year the carbon lamp reached the crest of its wave, the tungsten lamp made its debut. Only 52,471 were manufactured the first year. In seven years, however, the output had grown to 52,500,000 per year. While the output of the carbon lamp was falling to one-tenth of its former production, the output of tungsten lamps increased ten times.

With improvements in the lamp and in the methods of manufacture came numerous price reductions. Curves herewith show how the prices of the 25-watt, 40-watt, 60-watt and 100-watt sizes (those having the largest sales) have been steadily reduced. The 100-watt size, which cost $2 in 1907, costs 65 cents at the present time, a reduction of 67.5 per cent. The 60-watt size cost $1.75 in 1907 and now sells at 35 cents, a decrease of 80 per cent. The 40-watt size, which cost $1.50 in 1907, is now

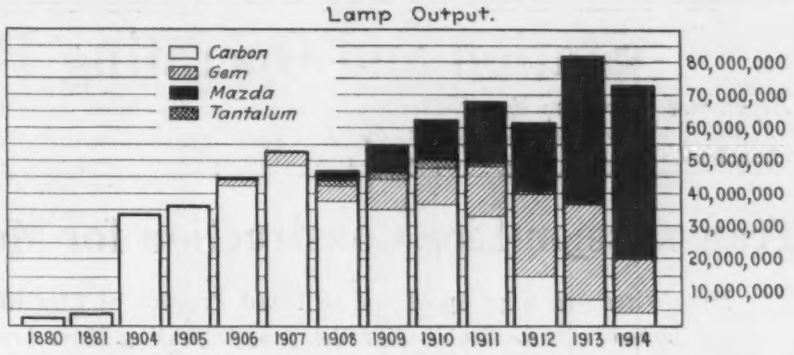
NUMBER OF LAMPS SOLD BY CLASS FROM 1904 TO 1914

Year	Carbon	Graphitized Filament	Tantalum	Tungsten	Total
1903	.....	.....	.....	.....	.....
1904	33,233,724	.....	.....	.....	33,233,744
1905	36,538,392	.....	.....	.....	36,538,392
1906	42,000,000	2,200,000	200,000	.....	44,400,000
1907	48,800,000	3,085,000	394,000	52,471	52,471,000
1908	37,979,000	4,419,000	998,000	3,315,000	46,712,000
1909	35,231,000	9,761,000	1,672,000	7,701,000	54,375,000
1910	36,495,000	11,608,000	2,433,000	12,232,000	62,773,000
1911	32,961,000	14,963,000	1,995,000	18,044,000	67,952,000
*1912	15,300,000	24,452,000	658,000	20,757,000	61,167,000
*1913	7,880,000	28,705,000	.....	45,000,000	81,585,000
*1914	4,500,000	16,114,000	.....	52,500,000	73,114,000

*Number of lamps shown here has been estimated by using an average selling price.

LAMP OUTPUTS CONTRASTED OVER A QUARTER-CENTURY

This diagram shows the steady growth in the number of incandescent lamps manufactured and indicates the relative part played by each type of illuminant in making up the total. The rise and fall of the carbon unit and the growth of the tungsten lamp are indicated by the shaded and black areas.



sold for 25 cents, a decrease of 83.3 per cent. The initial price of the 25-watt lamp, which was placed on the market in 1908, was 85 cents. Its price for 1915 is 25 cents, representing a decrease of 70.6 per cent.

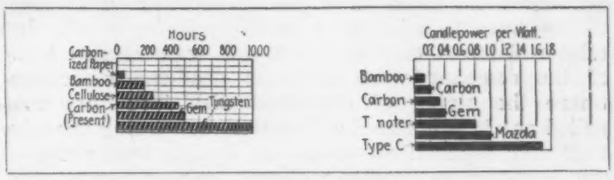
Since Edison produced his first lamp many scientists and research investigators have been devoting their energies toward improving the electric incandescent lamp. The amount of light to be had per watt of input has grown, as shown graphically herewith, from around 0.14 cp. per watt using the bamboo filament to about 1.7 cp. per watt for the gas-filled tungsten lamp. For the same energy consumption the user is able, therefore, in 1915 to obtain almost twelve times as much light as was possible with the first commercial lamps, representing an increase of 1075 per cent in efficiency.

Steady Increase of Luminous Efficiency

The increase in light for the same energy input for the four most popular sizes of Mazda lamps is shown in the figure at the bottom of this page. The 25-watt lamp has increased from 0.68 cp. per watt to 0.95 cp. per watt, the 40-watt lamp from 0.77 cp. per watt, to 0.96 cp. per watt, the 60-watt lamp from 0.775 cp. per watt to 1 cp. per watt, and the 100-watt lamp from 0.78 cp. per watt to 1.05 cp. per watt.

The useful life of carbon lamps, taken to 80 per cent of their initial candle-power, has also received attention. The first lamps had a burn-out life of from forty hours to one hundred hours. The average useful life was in the neighborhood of fifty hours. The useful life of the commercial carbon lamp is about 450 hours. The graphitized-filament lamp has a slightly longer life, while the tungsten lamp has a life of usefulness of 1000 hours. With the price of tungsten lamps only slightly higher than carbon units and with a useful life more than 120 per cent of that of the carbon unit, it is not difficult to see why in seven years the sale of tungstens has increased over ten times, while the sale of carbons has decreased to less than one-tenth of its former demand.

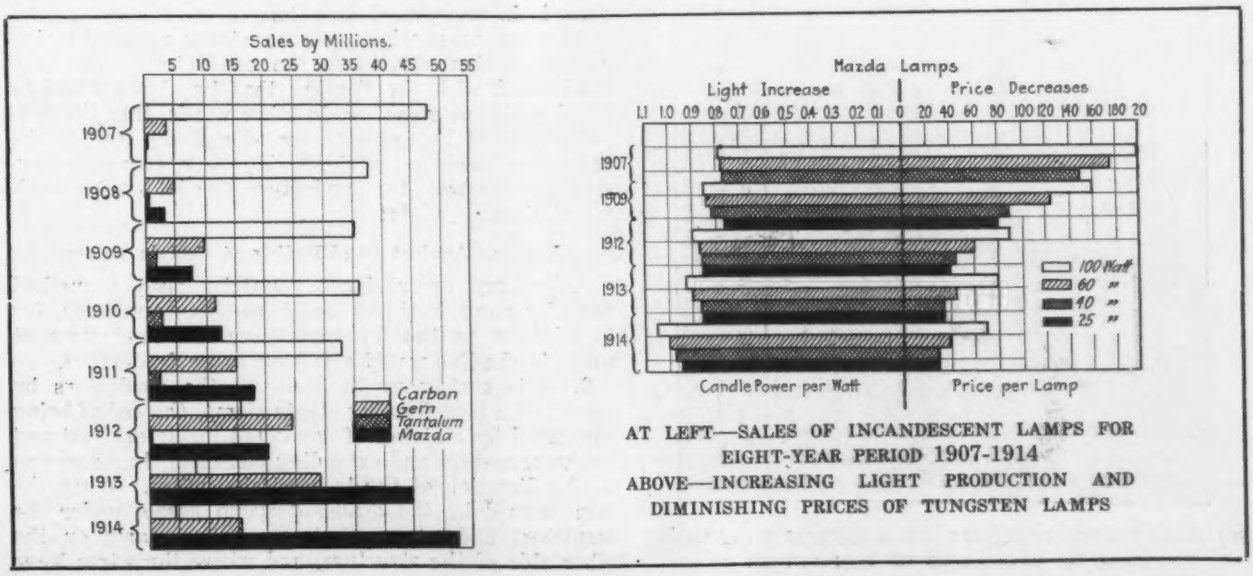
More than 96 per cent of the Mazda lamps sold in 1913 and 1914 were of the multiple type, the remainder



COMPARISONS OF BURNING HOURS AND LUMINOUS EFFICIENCIES OF EARLY CARBON AND MODERN INCANDESCENT UNITS

being of the series type. The four sizes most used, as already stated, were the 25-watt, 40-watt, 60-watt and 100-watt sizes. The following figures show the percentages of the total sales in these sizes for the years 1913 and 1914:

	1913	1914
25-watt	29.340	26.780
40-watt	27.110	26.323
60-watt	15.085	16.724
100-watt	5.722	5.799



AT LEFT—SALES OF INCANDESCENT LAMPS FOR EIGHT-YEAR PERIOD 1907-1914

ABOVE—INCREASING LIGHT PRODUCTION AND DIMINISHING PRICES OF TUNGSTEN LAMPS

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses.

Transmission-Line Construction for Mountain Districts

How Wires Are Kept Apart and in Fixed Position at Line Structures—Method Used by Southern Central-Station Company Operating Lines Across Virginia Valleys

BY H. M. SOMERVILLE*

THE mountainous districts traversed by the transmission lines of the Appalachian Power Company in Virginia and West Virginia present conditions that have demanded an economical design of line structure and one to which the conductors may be suitably fastened when situated in a wide valley or depression. When the usual design of structure is used to support high-voltage transmission lines under these conditions, the conductors are rigidly clamped to a number of these structures in order to obtain greater stability in the line than could be secured by simply suspending them from all of the supporting structures. It has been found that a large majority of the insulator failures on the 88,000-volt transmission lines of the company were at these dead-end structures where the string of connected disk insulators was pulled out in a horizontal direction, subjecting them to a greater mechanical strain and leaving both sides of the insulators exposed to moisture, rain and snow. To insure anything like equal insulation, more insulator disks are used at dead ends than at straight suspension structures, and no more dead-ending of conductors is done than is necessary for a proper stability of the line.

*Mechanical engineer Appalachian Power Company, Bluefield, W. Va.

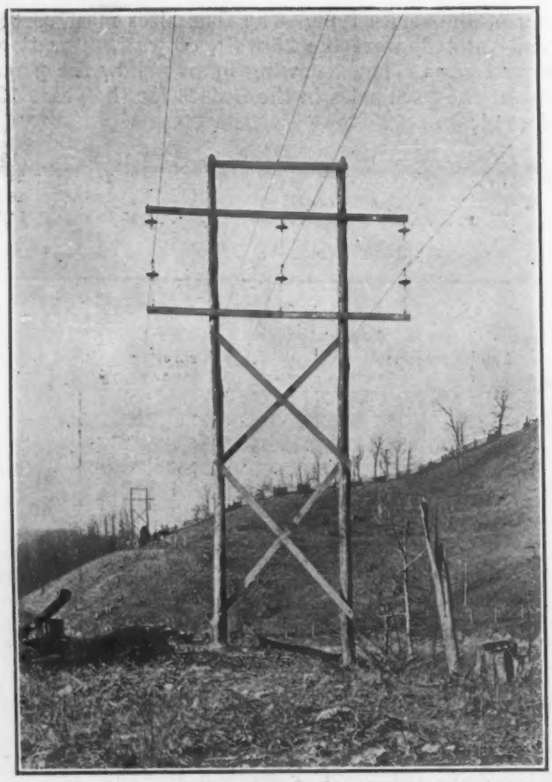


FIG. 1—A SIMPLE POLE-LINE CONSTRUCTION THAT TAKES CARE OF UP-STRAINS OF CONDUCTORS

In the case of a transmission line crossing a level country, certain structures a fixed distance apart are made dead-end structures. In the case of crossing mountainous territory, where supports are set sometimes on top of the mountain, sometimes on the mountainside, and again in the valley, the question of where the conductors shall be dead-ended always arises. In the case of the mountain-top structure and the hillside structure the wires may be suspended. In the case of a structure in the valley the straight suspension type of construction cannot be used, for the conductors exert an "up-strain" on the structure, owing to the fact that

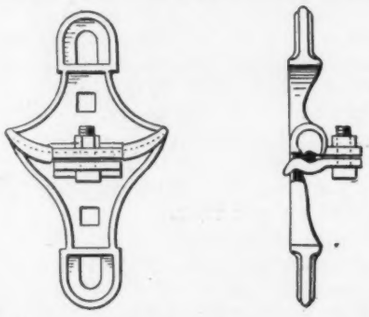


FIG. 2—THE CONDUCTOR CLAMP USED IN CONSTRUCTION SHOWN IN FIG. 1

the resultant force of the tension in the wires on both sides is in an upward direction.

In many cases where low structures cannot be simple suspension structures the conductors have been dead-ended with the thought that two birds could be killed with one stone, or, in other words, that the conductors could be properly spaced and the line at the same time made more rigid. However, there are several reasons why the conductors should not be dead-ended at such points:

Reasons Against Dead-Ending at Certain Points

1. In very mountainous countries such a method calls for more dead-end structures than necessary, for in addition to the low structures the conductors at turns in the line would also have to be dead-ended.

2. It is customary to dead-end the conductors by means of a loop-forming strain clamp, the clamp being supported by a string of connected insulators fastened to the cross-arm and extending out from the cross-arm in the direction of the transmission wires. When the loop formed by the dead-end clamp passes under the insulators and cross-arm to a similar clamp on the other side of the structure, and where the wires leave

the supporting structure in an upward direction from both sides, not enough clearance will be obtained between the loop and cross-arm unless an enormously large and expensive clamp and loop are employed.

3. Wires are usually pulled up to the proper tension at dead-end supports and a dynamometer used at this point to indicate when the maximum allowable tension in the conductor has been reached. If a dynamometer is attached to the wire at the lower end of a hillside span, the dynamometer reading will be correct for that point, but at points higher up on the hillside the tension in the wire will be higher than the tension indicated by the dynamometer, and a dangerously high tension might be reached. The tension at any point may be calculated, but a much simpler method is to pull up and dead-end the wire at its highest point of support, reading the maximum allowable tension on the dynamometer at that point, which will be the maximum tension in the wire.

Method Used by Appalachian Power Company

In those cases where it is impracticable to use simple suspension at low points in the line and it is not advisable to dead-end the conductors, the Appalachian Power Company on its high-tension transmission lines in the mountains of Virginia and West Virginia uses the method of fastening conductors in a fixed position shown in Fig. 1. The wire is suspended in the usual way, and kept from pulling up against the cross-arm above by means of a second cross-arm below, to which the wire is tied down by suspension insulators placed in a manner similar to the string of suspension insulators above the conductor, the wire being thus secured between two groups of suspended insulators.

Since there are two sets of insulators for the "up-strain" structure and also two sets for the dead-end structure, the question may arise as to which is the cheaper of the two types. This question is settled by the fact that each set of insulators of the dead-end structure must contain more disks than a single set of the suspended insulators, and therefore for equal insulation the cost of insulators for the "up-strain" structure is less than for the dead-end structure. Further, the "up-strain" structure is easy to erect as compared with the dead-end structure, and it is much easier to fasten the wires in between the two cross-arms than it is to form a dead-end. Again, the cost of one simple "up-strain" clamp, as shown in the accompanying illustration, is only a small portion of the cost of the loop-forming strain clamps required for dead-ending.

Some Difficulties Encountered

The "up-strain" clamp shown in Fig. 2 is a development of a clamp which was the product of necessity. When the method of suspending high-tension transmission wires by means of connected disk insulators was first used in the mountainous district already mentioned, it was found that wires suspended in warm weather from structures situated at a lower level than the two adjacent structures would often pull up against the cross-arm above when the weather turned extremely cold. To prevent this, a lower arm was added and the wires were tied down to it by means of a second string of insulators fastened to the ordinary suspension clamp. The suspension clamps had no place for attaching a second string of insulators below the clamp, so that the top insulator of the lower set was fastened to the upper part of the clamp by means of a piece of wire. Later, the idea was conceived of turning the suspension clamp upside down and fastening the lower set of insulators to the eye of the clamp, leaving the upper arm and set of insulators off altogether. However, an unforeseen trouble came up on account of the wires being

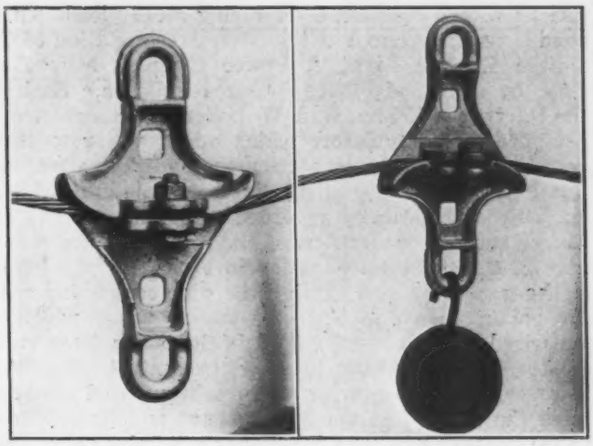


FIG. 3—TWO WAYS OF USING CLAMPS TO HOLD CONDUCTORS IN A FIXED POSITION

strung and tied down in cold weather and commencing to slack off as the weather became warmer, finally relieving the string of insulators of any pull in an upward direction and allowing them to collapse and unhook. If the temperature of the wires continued to rise, they would sink until they touched the cross-arm below, burning it off, or, if the temperature fell, the wires would rise high in the air, leaving them without support.

The clamp shown was then designed and patented by the writer for such structures, having the wire seat curved slightly upward at the ends and an eye above and below the clamping parts so that the two necessary sets of insulators might be attached. Thus the wire is held firmly between two supports, relieved of both "up-strains" and "down-strains," with no cumbersome loop or edgewise insulators. Where the "up-strain" is small, or in cases where the wire is suspended but is so light that there is danger of its being blown up into the cross-arm above, a cast-iron weight may be attached to the lower eye of the clamp which will hold the wire down, as shown in Fig. 3. In fact, the use at all points of suspension of the double-eye clamp with weights or a second set of insulators adds an extra safeguard to the line.

AUTOMATIC CONTROL OF FEED WATER

A Method for the Regulation of Boiler-Feed Water According to Evaporation

To obtain the best results from a boiler the feed water should be supplied continuously and maintained at a relatively high level during light loads to store heat and at a lower level during peak loads so that steam will be quickly available from the furnace con-

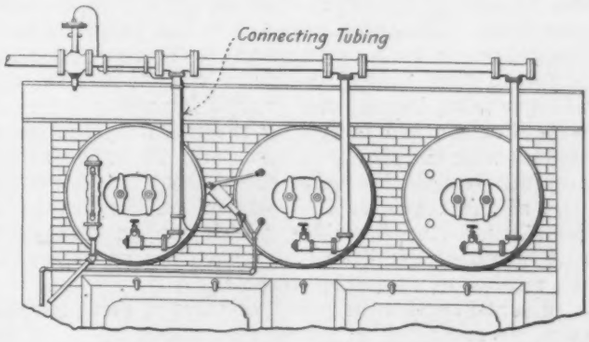


FIG. 1—ARRANGEMENT AND CONNECTIONS OF BOILER-FEED REGULATORS

ditions with a constant level during steady load. These conditions are secured at the 201st Street station of the United Electric Light & Power Compay, New York City, by a method of feed-water regulation. Each of the thirty-two 650-hp. B. & W. boilers in this station is equipped with regulators which admit water to their respective boilers in proportion to the evaporation, the water pressure in the supply line being maintained constant by automatically governed feed pumps. The arrangement and connections of the regulators are shown in Fig. 1 and the construction in Fig. 2.

The generator surrounding the pipe connecting with the boiler, shown in Fig. 2, contains water which is vaporized when the water level in the boiler drops sufficiently to permit steam to enter the central tube. For instance, with one-quarter of the tube exposed to steam from the boiler just enough pressure will be produced in the generator to open the diaphragm valve about one-quarter way. Similarly, with steam in contact with

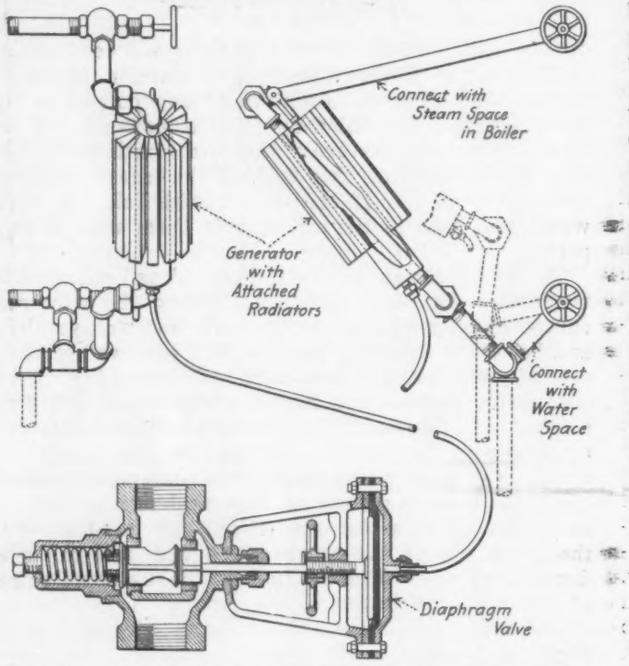


FIG. 2—CONSTRUCTION OF EQUIPMENT FOR THE AUTOMATIC REGULATION OF BOILER-FEED WATER

This illustration shows the design of regulator used by the United Electric Light & Power Company of New York City as made by the S-C Regulator Company, Fostoria, Ohio. It consists of a closed cylindrical shell or "generator" with attached radiators connected with the water and steam space in the boiler. The diaphragm valve connected with the generator admits water to the boiler. The pipes connected with the boiler are flexibly joined by two short pipes and a pipe passing through the generator so that the position of the latter can be changed to meet operating conditions.

the interior of the entire tube the valve will be opened completely. Excessive pressure cannot be produced in the generator, for as soon as any pressure exists water is forced from around the steam column into the diaphragm valve, leaving only part of the water in contact wtih the tube and increasing the radiating surface in contact with the steam. Usually only 25-lb. pressure is required to open the valve completely. The sensitiveness of the regulator is dependent on the amount of radiating surface provided, which can be changed to suit operating conditions by increasing or decreasing the number of radiating sections.

In actual service the regulator valve is about one-half open, necessitating a pressure of about 21 lb. in the generator. When water in the boiler drops 0.5 in. or 0.25 in. the regulator generator pressure is increased

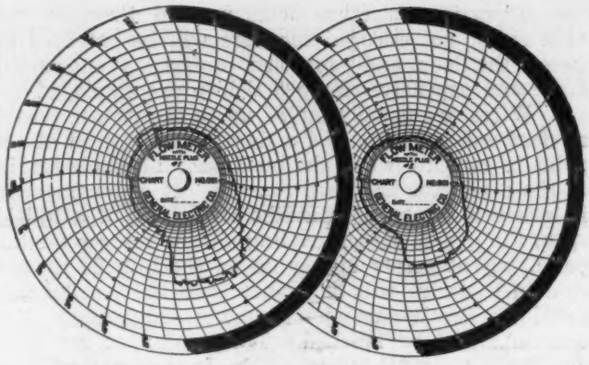


FIG. 3—RECORDS SHOWING VARIATION IN DEMAND FOR STEAM

to 22 lb., which means an additional opening of the valve. A subsequent rise of 0.25 in. to 0.5 in. in the boiler caused by dropping off of load would therefore require a decrease of only 1 lb. in the generator pressure to obtain the proper opening in the valve for lighter feed. This is accomplished almost simultaneously with the change in water level, or, for further illustration, during one test, when it took eighty-five seconds to reduce 22 lb. pressure in the generator, it required about four seconds to make a 1-lb. reduction.

This regulating arrangement requires little attention, since the apparatus has only one moving part, the diaphragm-valve stem. Every three to six months the generator needs refilling with water. There is practically no opportunity for water to leak out of the generator as it is made of a seamless shell with brazed ends connected with the diaphragm by seamless tubing. Even if water should leak out, it would be noticed because of the gradual drop in water level. Provision is made for hand regulation when the automatic apparatus is cut out for any reason. In case it is found desirable to change the limits of the boiler-water level it can be easily done by altering the angle at which the generator is supported. This is permitted by the linkage of pipes connected with the boilers.

The diagrams of Fig. 4 compare the water flow, regulator-valve travel and water level under different load conditions during twenty-four hours. The three upper curves are records of boiler evaporation as measured by three standard devices. The bottom record shows that the water is kept at a low level during heavy loads and a higher level during light loads.

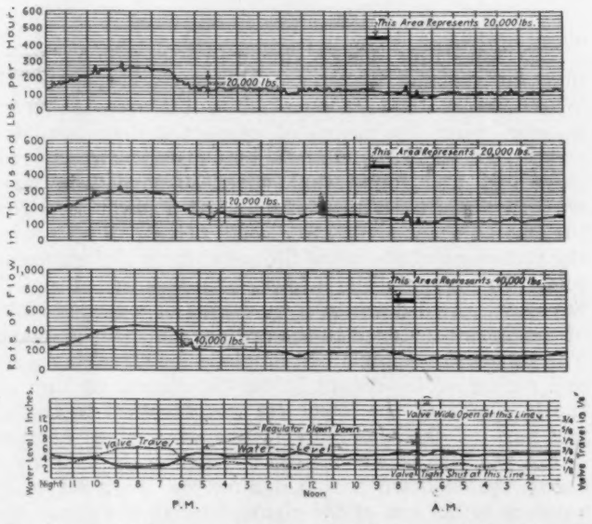


FIG. 4—RECORDS OF WATER SUPPLIED TO BOILERS AND VARIATION IN WATER LEVELS

CONCRETE ENGINE FOUNDATIONS

The Fundamental Requirements, Necessary Area and Method of Construction

BY H. COLIN CAMPBELL

On account of the facility and rapidity with which concrete may be placed, it has practically supplanted masonry construction for machinery foundations. Adaptability to irregular excavations, capacity for reinforcement when necessary, and ability to withstand the effect of vibration, such as occurs from running engines, are distinctive merits of concrete in such construction. It is seldom necessary to reinforce concrete foundations unless they are likely to be subjected to excessive side thrust, vibration, or other unusual strains. Where the bed extends above ground some distance, reinforcing is occasionally used to counteract stresses arising from contraction and expansion due to temperature changes.

The fundamental requirements leading to the successful use of concrete in engine foundations may be summarized as follows:

1. Natural mixed aggregate, such as bank or pit-run, or artificially prepared mixtures should not be used. Correct proportioning of the several ingredients is necessary to secure maximum density.

2. Different classes of aggregate should be kept separate until they are to be combined in the concrete mixer. Aggregates should be clean, that is, free from clay, loam and organic matter.

3. Foundations for smooth-running small engines and light machinery causing little vibration and no impact should preferably be made of a 1:2½:5 mixture of cement, stone and sand. Foundations for heavy engines and machinery not causing excessive vibration or impact should be of a 1:2:4 concrete mixture. Foundations for all machinery causing excessive vibration and heavy impact should be of a 1:1½:3 concrete mixture.

The factors for determining the area of engine and machinery foundations include the area of the engine base and character of the supporting ground. The safe load for different soils varies, as shown in the following table:

Character of Supporting Ground	Safe Load Tons per Sq. Ft. Bearing Area
Ledge rock	36
Hardpan	8
Gravel	5
Clean sand	4
Dry clay	3
Wet clay	2
Loam	1

Sand in strata of sufficient thickness forms one of the firmest and best foundations. It must, however, be confined when wet, so as to prevent spreading. Compact gravel will carry loads varying from 8 to 10 tons per square foot. The bearing power of soils increases when compacted, that is, the greater the depth to which the foundation footing is placed the greater will be the bearing power of the soil.

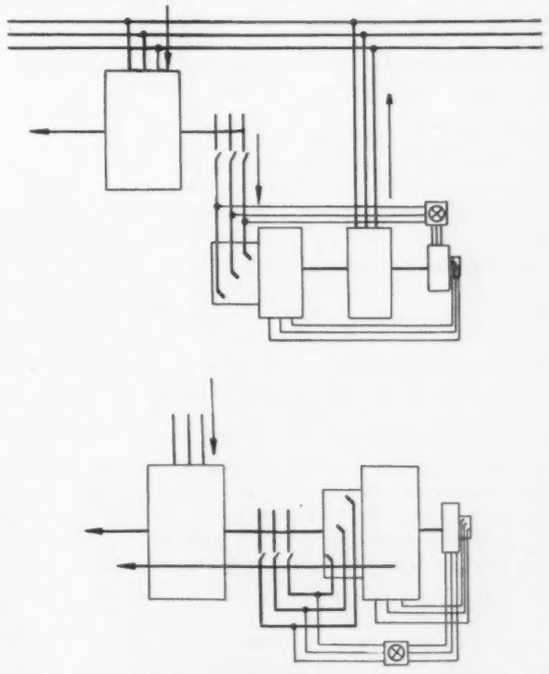
The depth of plain concrete foundations should be at least twice the offset distance. Heavy foundations requiring a bearing area larger than the engine or machine base may have sloped or stepped sides. In any case the offset should be as given above. The depth of a reinforced-concrete foundation should be determined by actual design for each problem according to the weight of the imposed loading and character of foundation.

Whenever a foundation is to be constructed on filled ground which cannot by ordinary tamping or compacting be made solid enough to insure carrying the superimposed load without settlement, the weight must be distributed by a footing. In the case of soil having such low bearing power as to require excessively wide footings, reinforcing should be introduced in the footing to distribute the load on the slab without injuring it. Concrete foundations and footings may be keyed by partly embedding vertical rods or horizontal I-beams in the footing. If, in placing the foundation, the concrete in the footing hardens before the work is continued, the upper surface of the footing should be cleaned, roughened and thoroughly wet, and then painted with a thin grout mixed in the proportion of a sack of cement to 1 cu. ft. of sand, before continuing the placing of concrete. When the earth is firm enough, the sides of an excavation will serve as a form for that part of the foundation that is to be below ground.

Anchor bolts should be embedded in the concrete, being held in correct position by suspension through holes in a templet resting on the foundation form. The location of holes in the templet should correspond to their location in the bed plate, or base of the engine. Sometimes anchor plates or large washers are placed on bolt heads to effect greater security when embedding them in the concrete. The bolt ends projecting above the template should be covered when placing concrete, to prevent spilling concrete on them and thus making threading on or off of nuts difficult. Usually engines and dynamos may be placed in position and started after the concrete has had ten days to two weeks for hardening.

Two Control Systems for Steel-Mill Motor Drives

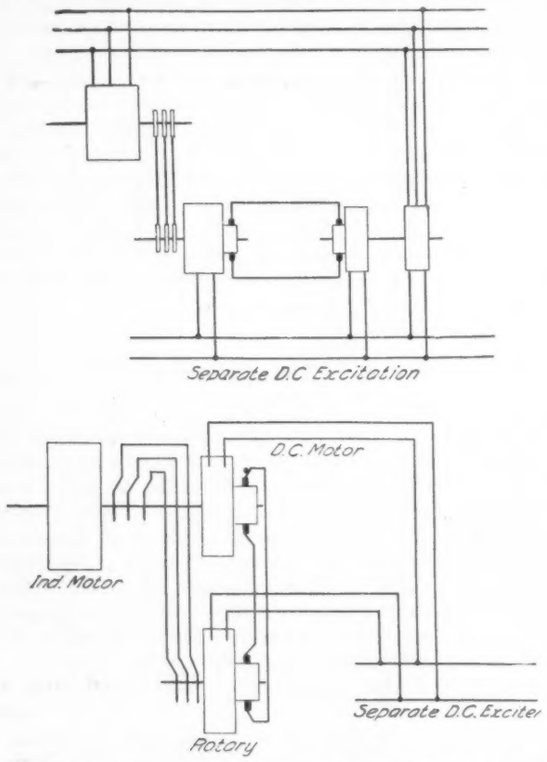
Two commercial systems by which the speeds of steel rolling-mill induction motors may be economically varied over considerable ranges were described by K. A. Pauly in a paper presented at the recent convention of the Association of Iron and Steel Electrical Engineers. These are known as the Scherbius and rotary-converter systems. The first, of foreign origin, is shown in Figs. 1 and 2. The slip energy, or that usually dissipated in a rheostat of the main induction motor, is delivered to a polyphase commutator connected to the slip-rings of the main induction motor and either returned to the



FIGS. 1 AND 2—ARRANGEMENT OF MACHINES FOR SCHERBIUS CONTROL SYSTEM

power system through an induction or synchronous generator driven by the polyphase commutator motor or to the main roll shaft by mounting the alternating-commutator motor on the mill shaft. The rotary converter system differs in the method of returning the slip energy of the main roll motor to the power system or to the main roll shaft. The slip energy is converted to direct-current power by a rotary converter connected to the slip-rings of the main roll motor and either returned to the general distributing system through a motor-generator or delivered to a direct-current motor mounted on the main roll shaft. Diagrams of this system are given in Figs. 3 and 4.

From tests it is believed that when such factors as speed range and overload requirements at all speeds, together with the speed and design of the induction motor driving the rolls, are favorable, rotaries and motor-generators standard for other service can be used. In general, high frequency (sixty-cycles), large rating and range of speed control favor the rotary-converter system, although the speed range required by the rolling-mill practice seldom handicaps the Scherbius system when the power supply is twenty-five cycles.



FIGS. 3 AND 4—ARRANGEMENT OF MACHINES FOR ROTARY-CONVERTER CONTROL SYSTEM

How One Operator Used a Crane in Repairing an Armature

In the Long Island Railroad substation at Hammels, N. Y., recently it was necessary to replace the binding wire on the armature of a 1000-kw. rotary converter. This operation called for some way of winding about twenty turns of piano wire about the full circumference of the armature in such a way as to make the band tight with equal tension in the different turns. The scheme tried at first was to mount the piano-wire reel so as to turn freely and pass the wire through a tension regulator consisting of two fiber-lined blocks bolted together. The wire was then wound as evenly as possible on the armature by turning it with bars, a method that was found slow and clumsy.

The rotary was of the type that is brought up to speed with an induction motor with its rotor mounted on the shaft of the rotary armature. The idea was therefore conceived of removing the stator of the induction motor and using the rotor as a drum or pulley to rotate the rotary armature. Three turns of a 1.25-in. rope were wound on this rotor, and one end was fastened to the hook of the traveling crane. The crane was then run the full length of the station with one man feeding the rope to the drum and keeping it taut. In this way a smooth and tight band was wound on the armature with considerable saving in time over turning it by hand.

Operating Data and Costs for a Kansas Plant Serving City of 15,000

The accompanying statistics show load conditions and income for the electrical plant of the Coffeyville (Kan.) Water & Light Department. Compared with average data from another Middle West State (Iowa statistics, 1914) for plants in similar-sized communities, the number of consumers per 100 population, the station rating and the income per consumer are slightly less, but the income per kilowatt of station rating and the load-factor are higher.

It is interesting to note that the investment per kilo-

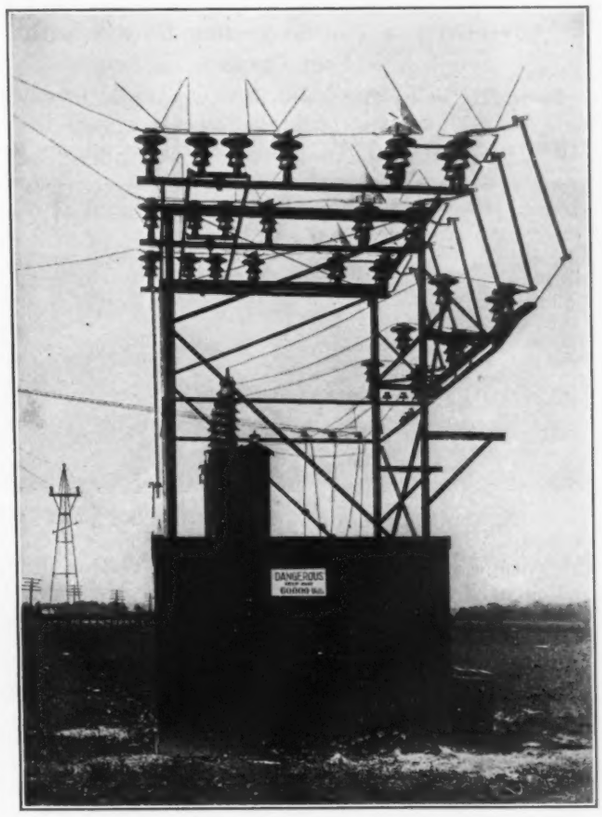
OPERATING DATA AND COSTS OF COFFEYVILLE PLANT

Number of consumers	1,353
Estimated population served	15,000
Number of consumers per 100 population	9
Station rating in kilowatts	900
Station rating per capita in watts	60
Rating of transformers in kilowatts	2,047
Total number of transformers in use	196
Average kilowatt rating of transformers	10.4
Kilowatt transformer rating per kilowatt station rating	2.27
Kilowatt lighting load connected	993
Kilowatt power load connected	1,070
Horsepower load connected	1,547
Kilowatt heating load connected	166
Total kilowatt load connected	2,229
Kilowatt lighting load per kilowatt station rating	1.1
Kilowatt power load per kilowatt station rating	1.19
Kilowatt heating load per kilowatt station rating	0.18
Total kilowatt load connected per kilowatt station rating	2.47
Kilowatt transformer rating per kilowatt of connected load	0.91
Total annual kilowatt-hours output at switchboard	3,551,030
Total annual kilowatt-hours output per capita	236.7
Total annual kilowatt-hours output per consumer	2,624
Annual load-factor in per cent	51
Total kilowatt-hours registered by consumers' meters	2,906,400
Per cent of output unaccounted for, including transformer, meter and line loss	18.2
Cost in cents per kilowatt-hour output for operating and maintenance expenses	0.96
Cost in cents per kilowatt-hour output for interest on outstanding bonds, appropriation for sinking fund, depreciation, taxation, operating and maintenance expenses	1.26
Cost in cents per kilowatt-hour output for interest on investment at 5 per cent, depreciation at 5 per cent, operating and maintenance expenses	1.39
Dollars income per kilowatt of station rating	66.38
Dollars income per consumer	44.15
Dollars income per capita	3.98
Cents income per kilowatt-hour output	1.68
Dollars investment per kilowatt of station rating	185.65
Dollars investment per capita	11.16
Dollars outstanding bonded indebtedness	35,000
Percentage of gross income used for operating expenses	57.1
Percentage of net profit on Jan. 1, 1914, investment	9.8
Number of street arc lights in use	160
Number of street "white-way" lights in use	730

watt of station rating is almost five times that in some similar Iowa stations. On the other hand, a smaller percentage of the gross income is used for operating expenses. The superintendent of the plant is C. E. Stromquist.

A 66,000-Volt Outdoor Substation of Small Rating in the Niagara District

In the accompanying illustration is shown a 66,000-volt substation at Bergen, N. Y., employed by the Niagara, Lockport & Ontario Power Company. The equipment includes two 25-kw., 66,000-volt Westing-



A 50-KW. SUBSTATION FOR 66,000-VOLT OPERATION

house transformers. The platform on the steel structure is arranged so that a third transformer can be installed in case the rating of the station is increased. The switching and protective apparatus consists of a standard 70,000-volt Burke horn-gap switch, a Burke horn-gap lightning arrester, a choke coil and fuse.

Some Makeshift Fuse Repairs That Always Court Disaster

Makeshift methods of restoring service when fuses rupture are often used by central-station customers. Some of these practices court disaster and should be watched for by inspectors searching for faulty installations. In one installation where the plug type of fuse had ruptured one-half of an attachment plug had been screwed into place and a coin wedged between two pieces of printer's type employed to bridge the gap between the terminals in the plug. In another case a piece of wire was soldered across the threads and center contact. Still another method used is to cut one of the threads on the fuse plug so that it can be bent over on the center contact. A penny screwed into the fuse socket so as to make contact with the center of the plug and outside is another scheme.

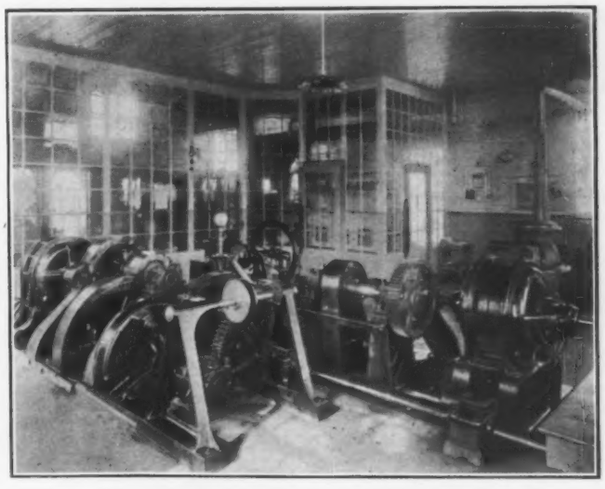
The most frequent method of repairing cartridge fuses seems to be to place a wire between the end caps or jaws holding the cartridge. Sometimes the wires are concealed by punching holes in the ends of both caps and inserting a fuse wire, which is then riveted over to make contact with the caps. Fuses repaired in the ways described, even if not "over-fused," may cause dangerous arcs which may ignite adjacent material. When over-fused they may allow the service wires to get so hot that fires result, or meter testers may be seriously burned in case they accidentally short-circuit a line.

Energy Required for Turning a 310-Ft. Bridge Across the Harlem River

Across the Harlem River at Willis Avenue, New York City, is a 310-ft. rim-bearing bridge which is turned by electric motors to permit river traffic. A 35-hp. motor is employed to take the weight of the bridge off the end supports and transfer it to the rim bearings before turning. The bridge is rotated by two 60-hp. slip-ring induction motors geared down and connected through friction clutches with opposite sides of the bridge-turning-shaft gear. A 3-hp. motor-driven air compressor furnishes the power for braking the movement of the bridge.

An ingeniously arranged mechanism is used to close the friction clutches on both turning motors uniformly and simultaneously. After the starting friction is overcome, one of the motors with its corresponding back gears can be disconnected and the bridge moved through the remainder of its travel by one motor. In this way the power is applied symmetrically to the turning shaft without the use of excessively heavy gears and the motors can be run close to their ratings. The motor and friction-clutch controllers can be seen at the center of the accompanying illustration. Roller bearings are employed to support the bridge while it is turning, there being sixty 2-ft. rollers.

During the period from April 1 to June 30, 1915, the bridge was turned 1553 times. Meter records show that 645 kw.-hr. was consumed per month on the average. Based on the number of turns per month, these figures indicate that 1.245 kw.-hr. was used per turn. Figured on the connected horsepower, the monthly consumption would be 4.08 kw.-hr. Energy for operating this bridge is furnished by the United Electric Light & Power Company.



MOTORS DRIVING BRIDGE-TURNING GEARS

Marketing Electricity

A Department on Selling Service and Widening the Use of Electrical Energy

Electric Vacuum Cleaner in Endurance Run

To demonstrate the durability of the vacuum cleaners sold in their establishment, Barker Brothers, 724 South Broadway, Los Angeles, Cal., recently arranged an endurance run on such a cleaner, which is to terminate only when friction causes the cleaner motor to stop. At the beginning of the test the oil cups of the machine were filled and were then sealed by Councilwoman Estelle Lawton Lindsey of Los Angeles. A large crowd witnessed the sealing of the cups. The machine was then connected to the mains of the Pacific Light & Power Company, to be kept in operation continuously until the supply of lubricating oil is exhausted and the motor stops because of friction.

The Reading Central Station Closes Its Letters "Electrically Yours"

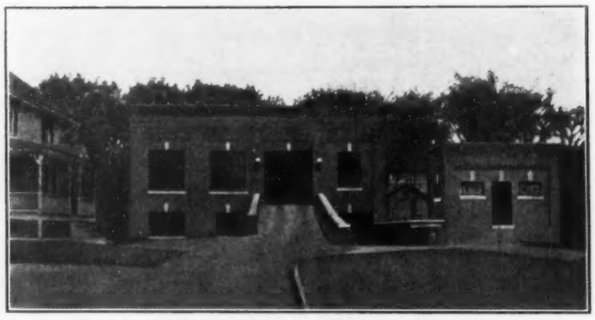
In place of the customary timeworn closing expressions for letters, such as "Very truly yours," the Metropolitan Electric Company, Reading, Pa., has lately adopted the expression "Electrically yours." Charles J. Esterly, sales agent of the company, feels that in this way the complimentary closing of the letter has been capitalized as appropriate advertising space where the company can make use of a distinctive phrase which will catch the reader's eye and impress on him that the company is always at his service electrically.

Data on Energy Consumption in the Manufacture of Tapestry

Individual motor drive is particularly desirable in tapestry factories, for here each machine has practically to be operated independently of all the others. At Morris Bernhard's plant in New York City thirty motors, having an aggregate rating of 30.5 hp., are employed. Twenty-six of these machines are 0.75-hp. units driving pleating, winding, weaving and spinning machines. Two winders which are larger than the others require 2-hp. and 3-hp. motors respectively. A 1-hp. motor is employed to drive a ruffer. In addition to the motors for driving the factory machines there is a 5-hp. motor which is connected with a blower. Some of the motors are directly connected with the machines they drive, while others are mounted on the ceiling and transmit their power through belts.

Advertising a Central-Station Garage with Post Cards

To widen the usefulness of its new garage, the Greenfield (Mass.) Electric Light & Power Company is distributing souvenir post cards illustrating on one side



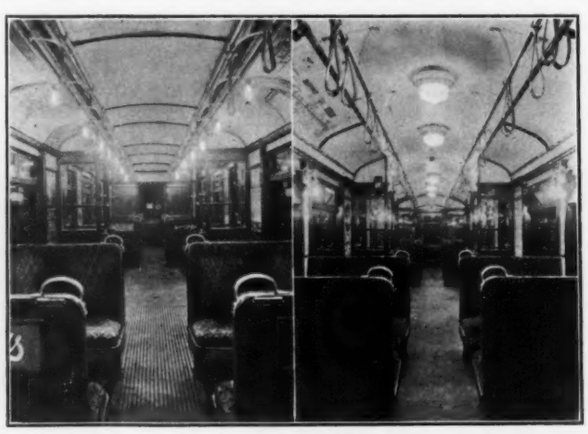
THE GARAGE AS PICTURED ON THE POST CARD

the garage exterior and on the other a section of the switchboard with charging panels for electric vehicles. The cards emphasize the day and night service available for electric-vehicle tourists and commercial cars and are given to patrons and others in a position to pass the word along that the company is maintaining these facilities.

Railway-Car Lighting in London Subways

In discussing the lighting of railway cars and other public vehicles at a meeting of the (British) Illuminating Engineering Society, some time ago, J. S. Dow pointed out the fact that whereas in most English steam-driven trains the illumination at the level of passengers' knees is not more than 1.5 to 3 ft.-candles, in the London underground "tubes" an illumination of 4 ft.-candles or even more is to be found. On one sec-

INDIVIDUAL MOTOR DRIVE IN TAPESTRY FACTORY



EXPOSED LAMPS AND CLUSTERS IN DIFFUSING GLOBES

tion of the Underground Railways in London experiments are being made with a system of cluster lamps in diffusing glass bowls mounted along the center line of the car, in place of the old method of using unscreened lamps down each side. The new method gives a much softer and more pleasant effect, and the illumination has been increased to an intensity varying from 5½ ft-candles to 7 ft.-candles, which is considered quite high. The chief defect in much of the railway and tramcar lighting in London, it is pointed out, however, is the presence of unshaded metal-filament lamps. These are distinctly glaring to the eye, but it is planned that they shall be gradually superseded by a more scientific arrangement.

Electric Roadster Built at Cambridge, Mass., on Gasoline-Car Chassis

The Cambridge (Mass.) Electric Light Company has just put into service a new electric vehicle which in many respects is unique. The car was built in the company's garage, and in its construction a Peerless steering and running gear and chassis with a 124-in. wheelbase was used. The diameter of the original wheels was cut down to 34 in., the standard size of the company's other cars. This change was the only one made in adapting the gasoline-car chassis to electric operation.

The motor is slung under the car about midway between the rear and forward axles. The method of suspension is by split-iron clamps around the motor frame, so arranged as to permit the coupling of the armature shaft directly to the universal joint of the original transmission shaft, which in turn drives the bevel gears of the rear axle. These gears have a ratio of 3 1/6 to 1. The total weight of the car complete with battery is 5000 lb., which is about 700 lb. more than it was at first designed to be. The greater part of this extra weight was added in order to give proper lines to the body.

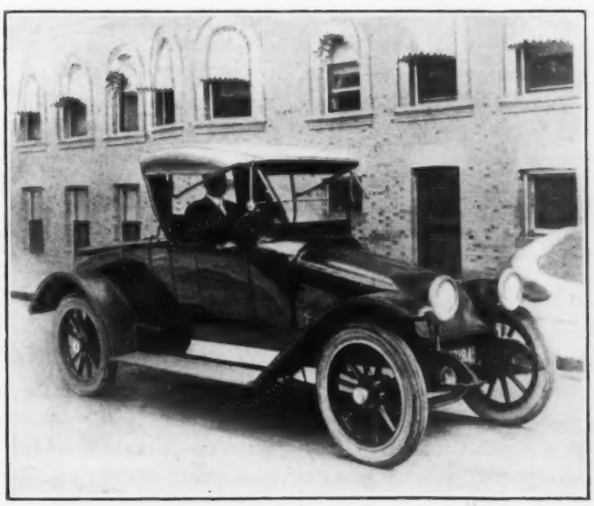
The source of electrical energy is a forty-cell "Ironclad" battery arranged in groups of four four-cell and two two-cell trays in each of the forward and rear compartments. The method of connecting the trays employs simple line couplings with four set screws, and was selected so that all connections should be above the battery in full view of the battery man while charging, and readily accessible from the front or rear of the car without his having to reach over the mud guards. The cells are fifteen-plate units with a normal charging rate of 40 amp. and 16 amp. and a discharge rate of 49 amp., with a rating of 220 amp.-hr. A Sangamo ampere-hour meter records the performance of the battery. The motor has a rating of 80 volts and 60 amp., runs at 1100 r.p.m. and weighs 380 lb. Speeds of 30 m.p.h. on the level and 21 m.p.h. up hills are ordinary everyday running records, and when this electric vehicle is caught in a line of gasoline cars it is able to hold its place without any break in the line.

Referring to the illustration, it will be seen that the car body consists of front and rear hoods, which are of sheet-iron. The top and wind shield were made as small as possible in order to cut down windage. On close inspection of the rear hood it will be seen that there is paneling just back of the front seat.

This rear hood, besides being the battery compartment, also contains a second seat. This second or rear seat is of the invisible type when closed; that is, there are no door handles or latches that show, and it is impossible to open this seat except by means of a secret device known to the operator of the car. Under this seat are kept with perfect safety the tool boxes and any robes or wearing apparel. If the vehicle is left on the street unattended, no one without knowledge of the secret method of opening this rear seat can take from the car any robes or tools.

Using Electricity to Dry Clothes of Outside Workers

In the club rooms of the Brooklyn Rapid Transit Company and in several stations of the police and fire departments of New York City electrically heated clothes driers have been installed so that men caught in rainstorms can have their clothes dried in a few minutes and resume work without danger of illness. The accompanying illustration shows several drying units as installed in one of the club rooms of the transit company. Each rack is pulled out individually for the reception or removal of clothes. The construction is such that each rack when pulled out its full length closes the aperture, retaining the heat within the drier. Each rack has a capacity of five complete suits of underwear, linen and uniforms, shoes being placed on a rack underneath. The driers have a double casing, thermally insulated to prevent radiation of heat, and are equipped with Simplex heating units and a motor-driven fan for producing a forced circulation of air. The installation was made by the Shannon Manufacturing Company.



"HOME-MADE" ELECTRIC RUNABOUT OF CAMBRIDGE ELECTRIC LIGHT COMPANY

ELECTRIC GARMENT DRIER USED BY BROOKLYN TRACTION COMPANY

How the Contractor Can Know Where He Stands

Applying Business Methods to the Computation of Profits and the Shop Cost of Labor and Materials

BY LOUIS W. MOXEY, JR., VICE-PRESIDENT KELLER-PIKE COMPANY, PHILADELPHIA

THERE is great need for better basic business methods among electrical contractors, and such methods are not only needed, they are wanted by the contractors themselves. The period of evolution has been short since the days when the "electrician" was just an independent, individual mechanic; there has been but little time for the development of system, and so too many men are daily suffering the costly consequences. To lend a hand, therefore, and make available to every contractor the groundwork of a better business practice, Mr. Moxey has put on paper this system, which he has found effective over a broad experience. It is well worth a careful study by every electrical contractor.

The two primary requisites for achieving success in the conduct of an electrical contracting business are a knowledge of electrical construction and the related engineering problems and a knowledge of business principles and methods. Each of these factors is of equal importance, and real success in the electrical contracting business cannot be obtained if either of these two factors be lacking.

Of primary importance to every contractor and every business man is the subject of profits. Every man in business desires to make a profit, but many have only a vague idea of the meaning of the word. To illustrate what is meant by the word "profit" take the case of a corporation. It has not made a profit on its year's business unless the amount of money received or assurable of collection without cost within a reasonable length of time exceeds the amount of money expended during the year. The amount of money expended by a corporation doing, for example, an electrical contracting business includes not only the amount paid for labor and material actually used on its jobs but all amounts paid for labor and material whether chargeable to any particular job or not. In other words, the material item should embrace the cost of engines and dynamos as well as ink and pencils, and the labor item should include not only the pay of the journeymen and helpers but also the salaries of the president and other officers.

If a corporation makes a profit on its year's business only under the conditions outlined, an individual or a group of individuals can make a profit only under the same conditions. The error which many persons who do a small business make is that they fail to include in the amount of money expended for labor during the year a salary for themselves. This should be equal to the sum that they would have to pay a person or persons for doing their work and producing the same results. Hence many persons doing a small business and neglecting to include a salary for themselves in the labor item do not make a profit. What appears to be profit may merely be a salary—perhaps meager at that.

TABLE I—COST OF ENGINES AND THEIR FOUNDATIONS INSTALLED READY FOR STEAM-PIPE CONNECTIONS*

Horsepower Rating	Cost per Horsepower		
	Single	Tandem-Compound	Four-Valve
50–100	$16.00	.....	.....
100–200	15.00	$26.00	$25.00
300 and above	14.00	24.00	23.00

*Installed ready for steam-pipe connections under ordinary conditions. The figures given are based on data from the Ames Iron Works, Oswego, N. Y.

TABLE II—COST OF DIRECTLY CONNECTED DIRECT-CURRENT AND ALTERNATING-CURRENT GENERATORS*

Direct-Current		Alternating-Current	
Rating, Kw.	Cost per Kw.	Rating, Kva.	Cost per Kva.
25	$25.00	50	$16.00
35	23.00	75	14.00
50	20.00	125	13.00
75	16.00	135	12.00
100	15.00	185	10.00
125	14.00	250	9.00
150	13.00	312	9.00
200	12.00	350	8.00
250	12.00	375 and above	8.00
300 and above	12.00	...	.....

*These prices are based on engine-driven generators installed under ordinary conditions, the sub-bases for the erection of the generators being furnished by the engine contractor. The values given are based on data obtained from the General Electric Company.

TABLE III—COST OF SWITCHBOARDS, INCLUDING DYNAMO AND FEEDER PANELS, 220 VOLTS OR LESS*

Direct-Current		Alternating-Current	
Rating, Kw.	Cost per Kw.	Rating, Kva.	Cost per Kva.
25– 50	$5.00–$10.00	50–125	$4.00–$6.00
50–100	4.00– 8.00	125–350	3.00– 4.00
100 and above	3.00– 6.00	350 and above	2.00– 3.00

*The range of prices is due to variations in the grade of materials and workmanship, the number of instruments, switches, etc. These figures include the switchboards erected complete and ready for the connection of generator cables, power and light feeders, etc. The prices are based on data obtained from the Walker Electric Company, Philadelphia.

TABLE IV—COST OF DYNAMO CONNECTIONS*

Direct-Current			Alternating-Current		
Rating, Kw.	Lead-Sheathed Rubber Insulation	Rubber-Covered Cable in Conduit	Rating, Kva.	Lead-Sheathed Rubber Insulation	Rubber-Covered Cable in Conduit
25– 50	$50.00–$150.00	$25.00–$125.00	50–125	$100.00–$300.00	$75.00–$275.00
50–100	75.00– 250.00	50.00– 225.00	125–350	200.00– 400.00	175.00– 375.00
100 and above	100.00– 350.00	75.00– 325.00	350 and above	300.00– 500.00	275.00– 475.00

*The average flat distance between dynamo and switchboard has been assumed as 25 ft.

There are two items which combined compose the cost of conducting an electrical contracting business. These must be taken into consideration when figuring profits. The first item includes the cost of materials and labor actually used on jobs, such as engines, dynamos, panelboards, conduit, wire, etc., together with the salaries of the foreman, journeymen, helpers and apprentices. This item may be called, for convenience, shop or raw cost.

The second item includes the cost of materials and labor expended in securing a contract and in the execution of the job. It embraces the salaries of the officers, bookkeeper, stenographer, bill clerk, draftsman, superintendent, etc., and the cost of rent, heat, light, taxes, insurance, stationery, postage, telephone and the like. This item is called manufacturer's expense or overhead charge. The shop or raw cost is always more or less an uncertain one and will be dwelt upon in detail, while overhead charges can be fairly well determined.

Method of Computing and Applying Overhead Expense

From the preceding paragraphs it can readily be seen that any estimate for work which does not include, in addition to an estimate of shop cost, an item for manufacturer's expense is one that will result in a loss to the contractor.

The writer has found it more convenient and logical to compute the manufacturer's or overhead expense as a percentage of the shop cost, instead of as a percentage of the selling price. An estimate of overhead expense should be made at least once or twice a year and the percentage thus obtained added to the shop cost in all estimates made in the succeeding period to obtain the real cost. For example:

Shop cost:	
Pay of foremen, journeymen, helpers and apprentices	$80,000.00
Cost of material, engines, generators, conduit, wire, etc.	200,000.00
Total shop cost	$280,000.00
Overhead expense:	
Salaries of employers, co-partners or officers	$30,000.00
Salaries of office employees—bookkeepers, clerks, etc.	8,000.00
Salaries of superintendent, draftsman and engineer	10,000.00
Stationery, telephones, taxes, insurance, rent, etc.	8,000.00
Total manufacturer's expense	$56,000.00

Manufacturer's or overhead expense as a percentage of shop cost equals $56,000 ÷ $280,000, or 20 per cent.

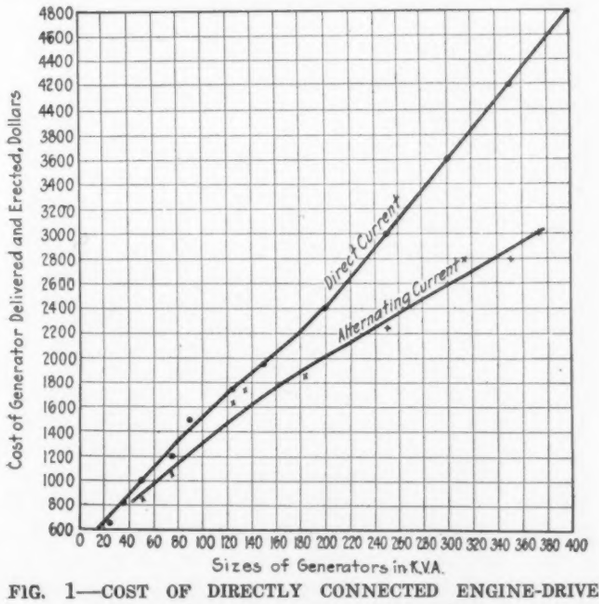


FIG. 1—COST OF DIRECTLY CONNECTED ENGINE-DRIVEN DIRECT-CURRENT AND ALTERNATING-CURRENT GENERATORS INSTALLED UNDER ORDINARY CONDITIONS, THE BASES BEING FURNISHED BY ENGINE CONTRACTOR

TABLE V—COSTS PER HORSEPOWER OF MOTORS AND NECESSARY RHEOSTATS AND CONTROLLERS ERECTED*

Direct-Current		Alternating-Current	
Horsepower	Cost	Horsepower	Cost
1 - 3	$50.00	1 - 1½	$60.00
5 - 7½	40.00	1½- 2	50.00
7½- 10	30.00	2 - 3	40.00
10 - 15	25.00	3 - 7½	30.00
15 - 25	20.00	7½-10	25.00
25 - 50	18.00	10 -20	20.00
50 -100	15.00	20 -35	18.00
100 -250	13.00	35 -75	15.00
250 and above	12.00	100 and above	13.00

*Motors are assumed to be of standard speeds, voltage, etc., and to be erected on floor, cost of foundations not being included. The costs include delivery and erection ready for wiring connections and are based on data obtained from the General Electric Company.

TABLE VI—COSTS OF WIRING AND CONNECTING MOTORS, INCLUDING ALL LABOR AND MATERIAL*

Horsepower	Porcelain	Molding	Conduit
1- 5	$7.50- $75.00	$10.00-$100.00	$15.00-$150.00
5-10	30.00- 120.00	40.00- 170.00	60.00- 240.00
15-25	75.00- 250.00	90.00- 300.00	150.00- 300.00
25-50	100.00- 400.00	125.00- 500.00	200.00- 500.00
50 and over	150.00- 500.00	200.00- 600.00	300.00- 600.00

*The range of figures is due first to structural difficulties, second to the type of motor panel desired, third to the voltage, and fourth to the circuit distance. The lower figures represent the minimum structural difficulties, with fused switches in an iron box and with starting device mounted exposed on wall to side of motor, 220-volt service and 50-ft. to 100-ft. circuit distance. The higher figures represent the maximum structural difficulties, motor panels with circuit-breakers, 110-volt service and 150-ft. to 300-ft. circuit distance. The figures do not include the cost of motors, rheostats and regulators.

TABLE VII—AVERAGE COSTS PER OUTLET FOR WIRING FOR LAMPS IN NEW BUILDINGS*

Outlets	Concealed Porcelain	Exposed		Concealed Conduit
		Wood Molding	Metal Molding	
Light	$4.00- $8.00	$5.00-$10.00	$8.00-$16.00	$7.00-$14.00
Switch	5.00- 10.00	6.00- 12.00	9.00- 18.00	8.00- 16.00
Wall receptacle	5.00- 10.00	6.00- 12.00	9.00- 18.00	8.00- 16.00
Floor receptacle	7.00- 14.00	8.00- 16.00	11.00- 22.00	10.00- 20.00
Fan	6.00- 12.00	7.00- 14.00	10.00- 20.00	9.00- 18.00
Iron	9.00- 18.00	10.00- 20.00	13.00- 26.00	12.00- 24.00
Electric heater	7.00- 14.00	8.00- 16.00	11.00- 22.00	10.00- 20.00
Vacuum control switch†	12.00- 24.00	13.00- 26.00	16.00- 32.00	15.00- 30.00

*For use where the total cost of the work is about $2,000. For residences the lower figures should be used. For public buildings, such as banks, office buildings, churches and the like, a figure midway between the range of figures given should be used. Where best grade of material and workmanship is required the higher figures should be used. Prices do not include costs of fixtures or appliances, but do include switches and receptacles. For wiring old buildings where porcelain work and conduit work is concealed the figures given should at least be doubled. If porcelain or conduit work is to be installed exposed in either old or new buildings, the figures should be increased at least 25 per cent, the difference of cost depending upon the purpose for which the building is or was designed.

†Includes automatic starter at motor.

TABLE VIII—AVERAGE COSTS FOR SIGNAL SYSTEMS RUN CONCEALED IN NEW BUILDINGS*

Bell Wiring	Costs per Outlet (Connected as One Outlet)	
	Porcelain	Conduit
Per push-button and bell	$6.00	$12.00
Per drop on annunciator	4.00	8.00

*For work on old buildings the figures given above should be doubled. The cost of push-buttons, bells and annunciators is included.

TABLE IX—AVERAGE COSTS OF PRIVATE TELEPHONES

	Porcelain	Conduit
Per desk telephone	$30-$50	$40-$60
Per wall telephone	25- 45	35- 55

The real cost, therefore, of the year's business would be the shop cost, $280,000, plus the overhead expense of $56,000, or $336,000. Should the selling value of this work be $369,600, the contractor has made a profit of 10 per cent on the investment made. Should the selling value, however, be only $334,992, he has lost 3 per cent on his investment. A true estimate should, therefore, be made for any job as follows:

Shop cost	$10,000.00
Overhead expense at 20 per cent	2,000.00
Real cost	$12,000.00
Profit at 10 per cent	1,200.00
Amount of proposal	$13,200.00

Some contractors figure their overhead expense as a percentage of the selling price. If a contractor's overhead expense is 20 per cent of his selling price and he desires to make a profit of 10 per cent on the selling price, he would not make it if he used the following method:

Shop cost	$1,500.00
20 per cent overhead expense plus 10 per cent profit	450.00
Amount of proposal	$1,950.00

To get the results desired—namely, 20 per cent of selling price as overhead expense and 10 per cent of selling price as net profit—the estimate should be made in the following manner: If the shop cost is $1,500, this amount must represent 70 per cent of the selling price, for the overhead expense is taken as 20 per cent of the selling price and the profit is taken as 10 per cent of the selling price. Hence the selling price should be ($1,500 ÷ 70) × 100, or $2,142. The overhead expense is 20 per cent of $2,142, or $428, and the profit is 10 per cent of $2,142, or $214. The sum of these two items, $642, subtracted from the selling price leaves the original shop cost of $1,500. Hence the previous method of estimating was in error by $2,142 — $1,950, or $192, as shown.

But the entire principle of applying overhead expense and profit as percentages of the selling price is wrong. Profit on a job is actually interest on an investment. The investment in the contractor's business is the sum of the shop cost and the overhead expense. Hence the profit should be computed as a percentage of this sum.

From a collection of data compiled by the National Electrical Contractors' Association on the costs of conducting an electrical contracting business, it appears that the overhead expense of an electrical contractor lies between about 15 and 25 per cent of his shop cost and that the average profit is figured at from 5 to 15 per cent of the gross cost, depending upon the terms of the contract and the nature of the work.

The following outline gives a list of items which enter into a contractor's overhead expense:

Officers' salaries.
Salaries of office employees.
Salary of superintendent.
Estimating and selling expense (car fare, railroad fare, entertaining, etc.).
Stationery and sundries.
Postage, telephone, telegrams.
Depreciation of tools and furniture.
Insurance on property, furniture, stock, etc.
Liability and compensation insurance (if any).
Interest on investment.
Rent (if owner of building, taxes and depreciation).
Heat and light.
Repairs.
Attorneys' fees.
License fees (if any).
Association dues.
Miscellaneous.

This list may be said to include the items which almost every electrical contractor must include in figuring his overhead expense, but not necessarily all the items which he must include. Most contractors find it necessary to employ one or more automobiles in their business. If such is the case, the interest on the investment made for automobiles, the depreciation of the machines, the cost of garaging, the cost of operating and the cost of upkeep must be included in the overhead expense. Some contractors have other expenses, such as advertising, etc., that are properly considered as items in overhead expense. Hence the list given is not complete but merely suggestive of the items which enter into a contractor's overhead expense.

Shop Cost of Labor and Materials

It is not the intention of the writer to present methods for ascertaining approximately the shop cost of labor and materials. No accurate figures for use in estimating the cost of the materials used on a job can be given, owing to the constant changes in price of most of these materials, such as wire, conduit, etc. On the other hand, while the rates paid for labor change, the changes are not of frequent occurrence and tables of labor costs can be worked out on the present rates for labor and any increase or decrease of rates can be taken care of by employing a percentage correction factor.

For engines, generators, motors, transformers, etc., it is always best to secure a bid on the apparatus direct from the manufacturer, especially if a reasonable time be given the contractor to prepare his estimate. It is preferable to have these quotations include the cost of the apparatus delivered and erected in position, as well as the cost of foundations, templets, bolts, painting, etc. There are two reasons for this procedure: First, unless the percentage of profit is large, the contractor should not undertake the risk of accepting the apparatus f.o.b. point of delivery and taking the responsibility for any damage that may occur to the same before it is accepted by the owner. Second, the contractor is very likely to omit a number of items in estimating on such apparatus, and these items combined may amount to a considerable sum even though each is small itself.

Should, however, the job be a large one and the time for preparing an estimate be short, the approximate cost of the apparatus could be determined if the contractor had prepared curves of cost for the various sizes of such apparatus in the past and had frequently checked them. Such checking is absolutely necessary, as apparatus may vary considerably in price within comparatively short periods of time. Fig. 1 shows how these curves should be prepared.

Separate curves or tables should be prepared for

TABLE X—AVERAGE COSTS OF PUBLIC TELEPHONES IN NEW BUILDINGS, CONCEALED WORK*

	Conduit
Per outlet	$5.00 to $15.00

*Cost of wires is not included since the electrical contractor very seldom does the wiring. The range of the figures is due to variations in the distances between outlets. Instruments are assumed to be furnished and installed by the telephone company.

TABLE XI—COST OF INSTALLING MISCELLANEOUS WORK*

Apparatus	Porcelain	Conduit
Time clocks	$30.00–$45.00	$35.00–$50.00 per clock
Time stamps	65.00– 85.00	70.00– 90.00 per stamp
Fire alarms	20.00– 30.00	25.00– 35.00 per alarm
Watchmen's stations	25.00– 35.00	30.00– 40.00 per station

*The range of the figures given above is due to differences in the grades of workmanship and materials. For old buildings the figures given should be increased from 25 to 50 per cent. These figures include the cost of apparatus as well as the cost of all conductors, conduits and labor.

directly connected and belted, single and four-valve or Corliss engines, also for directly connected and belted, direct-current and alternating-current generators of various types, as well as for motors of low, medium and high speeds, etc.

The same method could be followed for figuring the cost of certain other kinds of materials, although greater accuracy must be used in plotting some curves, for in some cases price differences of a few cents may be desired. This method is not intended to be pushed to its logical conclusion and made to apply to such items as switches, outlet boxes, receptacles and the like, the prices of which the contractor generally has at his finger tips, but it can be applied advantageously to such material as panel boxes, panelboards, doors and trim, annunciators, watchmen's clocks, etc. Tables I to XI, inclusive, give data from which such curves can be plotted, or, if desired, the data may be retained in tabular form. Too much emphasis, however, cannot be laid on the advisability of preparing such tables and curves from one's own records.

Convenient Home-Made Portable Equipment for Photometer Tests

To facilitate tests of street and interior lighting installations, the apparatus shown in the accompanying illustrations has been designed by William E. Hodge, deputy superintendent of street lighting at Springfield, Mass. Fig. 1 shows a special standard used in calibrating a Sharp-Millar photometer. It consists of an oak frame carrying two 1.375-in. by 0.75-in. horizontal bars fitted with iron rails on which travels a small lamp carriage equipped with a standard 2-cp. Electrical Testing Laboratories lamp. A standard steel tape calibrated in feet and tenths gives the distance of the lamp at any time from the photometer, which is easily attached to the bars at the left-hand end of the frame. At intervals along the bars are mounted a total of ten vertical screens each 6 in. square with apertures 2.5 in. in diameter and slots at the bottom to permit the horizontal movement of the standard lamp. The tape is attached to the carriage and moves with it, a light spring on the right-hand side of the carriage maintaining the necessary tension to give tautness. The screens are covered with velvet on the sides facing the lamp and with cotton on the sides toward the photometer. The standard lamp is provided with two flexible cords carrying two wires each for supplying energy and for voltage readings. At the left of the frame is an 8-in. by 20-in. shelf carrying a sliding rheostat and voltmeter. The leads to the lamp are held taut by small lead weights and pulleys and the milammeter used in field testing is equipped with a flashlamp.

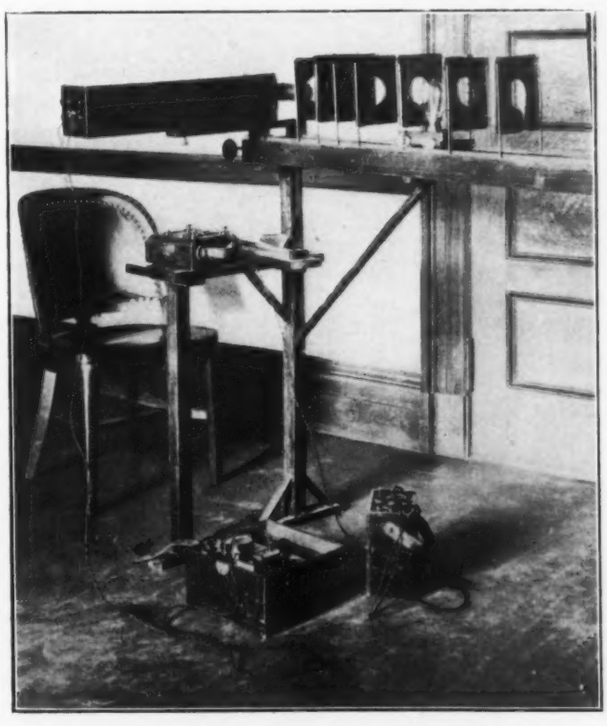


FIG. 1—PHOTOMETER APPARATUS IN USE

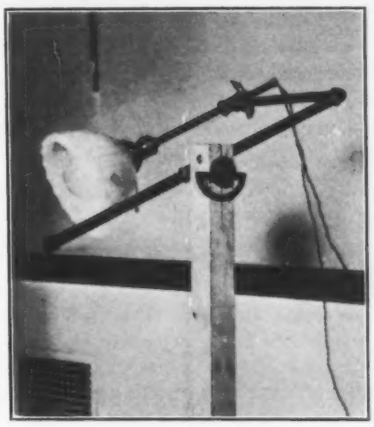


FIG. 2—ADJUSTABLE STAND FOR MOUNTING LAMP

A three-cell battery is used in supplying the standard lamp, which is a 5-volt outfit, and a similar two-cell battery is employed in operating the photometer lamp. The battery is mounted in a 5.25-in. by 10.5-in. by 5-in. portable wooden case, as shown. This compact box contains, in addition to the battery, a Weston millivoltmeter, a lamp and curved holder, 100 ft. of steel tape, a flashlamp, a plumb-bob, a resistor and a small slide rule. The cost of this special box was about $2, including a leather strap for carrying it. A home-made box for transporting the photometer has also been developed at a cost of about $5, the dimensions being 2 ft. 5 in. by 6 in. by 9 in.

Fig. 2 shows a convenient standard for setting lamps with reflectors or shades at different angles with the horizontal, with facilities for adjustable rotation. The fixture under test is screwed to a 0.5-in. brass pipe 18 in. long, the pipe being carried through a T and susceptible to turning about its longitudinal axis through angles measured by a scale shown at the rear. Extension arms of similar pipe are then carried around to a horizontal bearing clamped between the split halves of a 2-in. by 3-in. vertical wooden post fitted with a protractor, the post being about 4 ft. high and attached to a base equipped with leveling screws. The equipment is easily carried about, is inexpensive to build, and has been found thoroughly satisfactory in operation.

Nineteen "White-Way" Teams in One-Day Whirlwind Effort

Nineteen teams in all have been organized by the Board of Commerce at Lexington, Ky., to close the campaign for the "white-way" system in a one-day whirlwind effort. The teams, which have the support of public opinion, will call on all merchants who are listed as prospective subscribers, in an effort to close up the fund in one day.

Technical Advance in Theory and Practice

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

FIELD TELEPHONES FOR USE IN WAR

Interesting Developments in Telephone Design for Systems of Communication in the Trenches—Special Provisions for Transmitting Buzzer Signals When Circuits Are Impaired—Conveying Articulate Speech

The present European war has been aptly called a war of engineers. This is broadly true for all classes of engineers. The chemical engineer has to supply the explosives and adapt many chemical reactions, originally invented for peaceful work, to the requirements of the war. The electrical engineer is widely needed for installation for lighting and power purposes and transmission of signals and speech. The characteristic element of most of these installations is their temporary character and the speed with which they have to be installed and changed at short order. Concerning the electrical engineer's work in the special field of telephony in the trenches an interesting account was given in a recent paper by Charles R. Darling before the Royal Society of Arts in London, published in the London *Electrical Review* of Sept. 17.

The telephones to which we are accustomed in civil life are unsuited to military operations for two reasons: First, they lack portability, and, second, they are not, of course, provided with any means of transmitting messages by Morse code in the event of speech being inaudible. It has, therefore, been necessary to design special instruments for use in the field. The usual arrangement of parts in field telephones follows the lines indicated in Fig. 1. The primary circuit consists of a battery *B* connected to the primary winding of an induction coil *P*, and to the vibrator or buzzer *V* through the key *VK*. The microphone or transmitter *M* is placed in parallel with the buzzer and may be brought into the circuit by means of the key *MK*. The secondary circuit consists of the receiver *R*, one end of which is connected to line and the other end to the secondary winding *S* of the induction coil, which in turn is joined to earth through a condenser *C*. The arrangement at the other end of the line is identical with the foregoing, and to establish communication the operator at either end connects the line to the terminal *L* and attaches the terminal *E* to an earth-pin driven into the ground. In different forms of field telephones this circuit is modified in various ways. Most modern instruments possess a third terminal, placed between the condenser and the secondary winding of the induction coil, so that the condenser may be cut out or brought into the circuit as desired.

The buzzer or vibrator serves the double purpose of acting as a call and also as a means of transmitting messages by Morse code. In the simple form shown in Fig. 1 the action is identical with that of an ordinary electric bell. However, this simple form of buzzer has disadvantages and is now being replaced by a greatly improved instrument, the "D Mark III" telephone, which will be described later on. Although not essential to the transmission of sounds, a condenser inserted in the line circuit is a useful adjunct to a field telephone. While stopping the passage of direct currents, it permits alternating currents to pass through it, although somewhat impaired in strength. Owing to this property, a pair of field telephones with their condensers in circuit may be attached to an existing telegraph line and messages sent without interference. The direct currents used in telegraphy cannot pass through the telephones owing to the condenser; the alternating currents due to the telephones do not affect the telegraph instruments, and hence the two operations may proceed simultaneously.

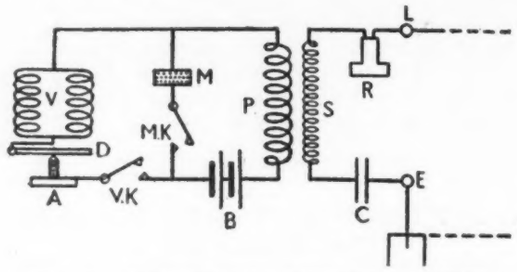


FIG. 1—ARRANGEMENT FOR SIMPLE BUZZER

This fact is frequently taken advantage of in the field. It is also customary to use a condenser in the circuit when tapping a telephone line, as less current is then diverted through the instrument used for tapping and the communication from end to end is not unduly interfered with.

The use of an earth return for a field telephone has the advantage of saving a second line, with the attendant trouble of laying out. Contact with the ground is secured by means of a pointed iron pin, about 14 in. long and ¾ in. in diameter, which is driven in to a depth of several inches. This pin carries a terminal and is connected to the telephone by a short wire. In damp ground a pocket-knife, or even a wire, inserted into the ground gives sufficient contact. In dry, sandy ground it is difficult to secure a good "earth," and it is necessary to pour water round the pin. Should this fail, a return wire must be used.

The special features of the "D Mark III" telephone, which is the latest service pattern, are the use of a polar-

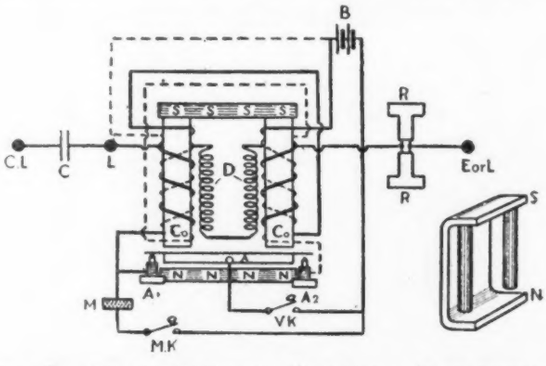


FIG. 2—ARRANGEMENT FOR "D MARK III" TELEPHONE

ized buzzer and the arrangement by which the windings round the cores of the buzzer are made to constitute the induction coil. The circuit is shown in Fig. 2. The action resembles that of the polarized bell used in ordinary telephones, but whereas this bell is actuated by an alternating current, a direct current only is available for the buzzer. The same result is secured, how-

ever, by causing the battery current to pass alternately through each of two windings round the cores, which, being oppositely disposed, produce opposite magnetic effects. The iron cores C_0 are mounted on the south pole S of a permanent magnet bent twice at right angles, as shown at the side of Fig. 2. The lower extremities of the cores will therefore possess S polarity. An iron

FIG. 3—ARRANGEMENT FOR "LADDER" SYSTEM

armature pivoted at its center is placed between the ends of the cores and the N pole of the permanent magnet. The upper face of this armature has N polarity and carries at either extremity a thin strip of steel. In the position of rest one of these strips touches an adjusting screw A_2. Each core possesses two windings, one right-handed and the other left. On pressing the buzzer key VK, the current flows through the armature to the screw A_1, and thence round the cores by the path indicated by the full line. This results in the S pole of the core opposite A_1 becoming strengthened, while that of the core opposite A_2 is weakened, and hence the armature is drawn away from A_1 and makes contact at the other end with A_2. The circuit completed by this contact is shown by the dotted line, and the effect now is to strengthen the S pole opposite A_2 and to weaken the other. Hence the armature leaves A_2 and again makes contact with A_1, and thus is set into rapid vibration. When the screws are properly adjusted, so as to make the throw of the armature even on both sides, a keen, sharply defined note is obtained, suited in every respect to calling-up or rapid Morse signaling. This buzzer requires a minimum current of 0.1 amp. for satisfactory working.

The secondary of the induction coil D, shown in the drawing at the sides of the cores, is wound over the buzzer coils, and every make or break of contact between the armature and the screws results in the production of an induced current in the secondary circuit, which, passing through the line and receivers at both ends, produces a response to the note of the buzzer. The microphone M is connected so that when its key MK is pressed the current passes through the full-line winding of the buzzer core, which then serves as the primary of the induction coil, the fluctuations in current caused by speaking into the microphone resulting in induced currents through the secondary circuit, as in the case of the buzzer. Two receivers R are used, joined to the same terminals. The terminal marked L or F is connected to a metal plate at the base of the instrument, which serves as earth contact. The condenser C is placed between the terminals L and CL, and is only in

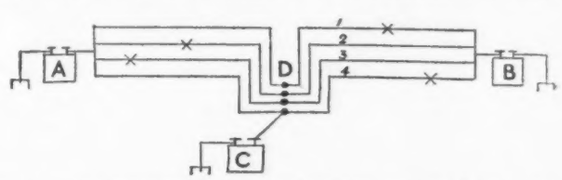


FIG. 4—ALTERNATIVE ARRANGEMENT TO THAT OF FIG. 3

the circuit when the line is connected to the latter. The instrument consists of two compartments provided with lids, the taller containing the cells and the lower the buzzer and condenser. On the lower lid are mounted the buzzer key, terminals for the two receivers and microphone, marked R and M respectively, and also three terminals, lettered L, CL and L or E, for connection to line and earth. The buzzer itself is fastened on the under side of the lid, and the condenser is at the bottom of the compartment. One of the two receivers is contained in a leather case provided with a head strap, so that it may be fastened to the ear when awaiting a call, leaving both hands free. The other receiver forms the upper part of a hand combination, which may be telescoped into a small size for packing, the lower part being the microphone, the key of which is in the handle. For transit all the parts are placed in a leather case, 8½ in. by 4 in. in plan and 6½ in. high, to which a shoulder strap is attached. The total weight is a little over 8 lb.

The use of two receivers is of distinct advantage. If the cords of one should break, the other may still be used, and the line circuit remains intact. Also, a very important message may be heard simultaneously by two men, the risk of misinterpretation being thereby greatly reduced. Further, one of the receivers may be detached and re-wired if necessary, without putting the telephone out of action.

The breaking of telephone lines by fragments of bursting shells is a very common occurrence, and as the cutting off of communications may have very serious results, measures are taken to maintain a complete circuit as long as possible. To this end multiple lines are used, and one arrangement, known as the "ladder" system, is indicated in Fig. 3. The wire is formed into a network resembling a ladder, with a connection at either end to the telephones A and B. Although numerous breaks may occur, as indicated by the crosses, a continuous circuit from A to B, marked out by the thick line, still exists. An alternative method is shown in Fig. 4, where four lines are laid between the telephones A and B, which at one spot are brought to junction D in a dug-out, where a lineman is placed provided with a telephone C. It must be understood that the lines, shown parallel in the drawing, may take widely different routes between the ends and the dug-out. As indicated by the crosses, all the lines are broken—1 and 4 on the right and 2 and 3 on the left of D. By joining each line in turn to the telephone C, these breaks and their bearings may be discovered. By joining the whole portions of the lines 4 and 2 or 1 and 3 at the junction box D, a continuous line between A and B is again established.

Generators, Motors and Transformers

Oscillation of Synchronous Motors.—E. BOULARDET.—A mathematical article illustrated by diagrams. An electric transmission is similar to an elastic coupling between generator and motor. Any variation in the coupling produces more or less damped oscillations. If the system consists of one alternator revolving with a constant angular speed and one synchronous motor, the latter will run with constant angular speed as long as the load does not change; but when the load changes the speed of the motor will be subjected to oscillations which in practice rapidly die out. But if in the generating plant several alternators are working and do not revolve with exactly the same speed at any moment, the synchronous motor will be subjected to speed variations even if its load is constant, and in certain cases these oscillations may assume dangerous amplitudes. In the present article the author studies these oscillations theoretically for the most general case, and shows that some results can be obtained without too complicated methods in spite of the complexity of the problem.—*La Revue Elec.*, July 2, 1915.

Ventilation of Traction Motors.—A note on a recent British patent (No. 21,825, 1914) of the British Thomson-Houston Company and the General Electric Com-

pany of this country for a system of cooling particularly applicable to traction motors in which air circulates both through and round the armature. The armature is connected at one end with the commutator through an air-tight joint, and it carries at the other end an enlarged head comprising a flange fitted with fan blades. —London *Elec. Eng'ing*, Sept. 23, 1915.

Lamps and Lighting

Filament Temperature.—M. Pirani and A. R. Mayer. —The first part of a theoretical and experimental investigation of the filament temperature of electric incandescent lamps. Some of the results are as follows:

	Watts Per Cp. Hor.	Watts Per Cp. Sph.	True Temp., Deg. C
Carbon	10.0	11.10	1615
	3.0	3.35	1900
	0.6	0.67	2440
Tantalum	10.0	12.20	1470
	2.0	2.45	1845
	0.5	0.61	2335
Tungsten	10.0	12.20	1475
	1.0	1.20	2080
	0.5	0.61	2355

The figures of true temperature are those found by the authors. The figures for the tungsten lamps refer to tungsten filaments in vacuo. The authors have also made a determination of the temperature of the filament for nitrogen-filled tungsten lamps. The article is to be concluded in a subsequent issue—*Elek. u. Masch.* (Vienna), Aug. 15, 1915.

Cadmium-Vapor Lamps.—Before the British Association for the Advancement of Science at a recent Manchester meeting, H. J. S. Sand exhibited a cadmium-vapor arc lamp which he recommended for polarimetric and other purposes. It was, he said, comparable in general principle with the well-known mercury-vapor lamp. The lamp was constructed of quartz-glass, and the cadmium was freed from oxide and dissolved gas by a process of filtration while at the pump. It was hindered from adhering to the glass by the presence of a small amount of a loose powder (zirconia) in the lamp. The metal was melted by external heating before starting, and maintained itself in the molten condition by the heat of the current. Once started the lamp might be kept burning for an indefinite time.—London *Electrician*, Sept. 17, 1915.

Generation, Transmission and Distribution

Electric Winding.—Reference is made to the influence of drum profile on the performance of a winder, and diagrams of a number of winders are given. The new 12-ton winder at the Cwm colliery belonging to the Great Western Colliery Company is described in detail. The drum is of spiro-cylindrical form, 12 ft. to 18 ft. in diameter. An unusual and interesting feature of the drum is that the small diameter is at the center. The drum is driven by two interpole motors arranged one at each end of the shaft. Each motor has a nominal (R. M. S.) rating of 900 brake-hp. at 28.6 r.p.m. The design of the drum is such that the load is very well equalized, and under ordinary conditions the two motors will not be required to exert a greater output than about 2700 brake-hp., but the motors are designed to be capable of giving well over 100 per cent overload if necessary. The motors are controlled on the equalized Ward-Leonard system. The motor-generator flywheel set consists of an 1800-hp. slip-ring induction motor coupled to two 750-kw. (R. M. S. rating), 550-volt continuous-current dynamos and a 40-ton flywheel. The set runs normally at 485 r.p.m., and the speed is varied by means of a liquid-type automatic slip regulator, so as to enable the flywheel to equalize the demand for power from the mains. This regulator is operated by a motor magnet, which is energized from the line through the medium of series transformers.—London *Electrician*, Sept. 24, 1915.

Traction

Electrification of British Railway.—The first part of an illustrated article on the electrification of the London and South Western Railway. The first part of the work is nearing completion. It comprises the conversion of 47 miles of route, equivalent to 140 miles of single track. The system adapted is direct current at 600 volts, with a third-rail conductor, this enabling traffic to be exchanged with the Metropolitan District Railway. The company decided to generate power for itself and has put down a power station alongside the railway at Durnsford Road, near Wimbledon, which is now practically complete.—London *Elec. Review*, Sept. 24, 1915.

Installations, Systems and Appliances

Number of Persons Employed in Germany's Electricity Supply.—F. Fasolt.—An estimate of the author shows that the number of persons employed at present in the public electricity supply stations of Germany is between 35,000 and 36,000. This number would not form a prohibitive difficulty should it be decided to introduce general municipal or state ownership in the German electricity supply.—*Elek. Zeit.*, July 22, 1915.

Earth Resistance.—E. W. Marchant.—A British Association paper. In connection with the wireless station at Liverpool some experiments have been made recently on the resistance to earth of three different types of earth plate. The earth most used was the water-pipe system of the building. In addition to this an earth was formed by fourteen 2-in. cast-iron pipes, pointed and driven about 1 ft. into the ground, which, in Liverpool, is a good yellow sandstone. A third earth was formed by a copper plate 1 ft. 5 in. wide and 4 ft. 6 in. long, buried vertically at a depth at the lower edge of 6 ft. below ground. To this were riveted two copper strips, 1 in. wide and 40 ft. long, laid at a depth of 6 ft. each. The earth resistance of copper plate and strips was found to be 6 ohms, that of the iron pipes 42 ohms, and that of the water pipes 3 ohms.—London *Electrician*, Sept. 17, 1915.

Wires, Wiring and Conduits

Wooden Poles.—Friedrich Moll.—The author shows that the time in which the replacing of wooden poles becomes necessary follows the law of the probability curve. This result is of importance as it yields a safe foundation for estimates of cost of transmission lines and depreciation. It is important that electrical engineers should understand that painting the wooden poles is valueless and that for the preservation of the poles it is absolutely necessary to impregnate them with tar oil and sublimate according to some such method as used by the German Post Office Department.—*Elek. Zeit.*, Sept. 2, 1915.

Electrophysics and Magnetism

Thermionic Currents.—An account of a discussion before Section A of the British Association meeting at Manchester. Prof. O. W. Richardson opened the discussion and said that in a vacuum there were two different emissions of ions by pure metals which have no connection with each other. One is the emission of positive ions of atomic dimensions, which is strongest on the first heating and usually due to impurities such as sodium and potassium atoms. The other is the emission of negative electrons, which continues indefinitely, as in the Coolidge tube. This latter emission increases geometrically as the temperature rises arithmetically. The author discussed at length the question whether

this emission has a physical or a chemical origin. The Haber and Just phenomenon seems primarily a chemical phenomenon. In the case of tungsten, on the other hand, the chemical theory is, in the speaker's opinion, utterly inadequate. The author concluded that the thermionic emission was in the main a physical phenomenon, the stream of electrons having a close analogy to evaporation. In the extended discussion which followed E. Newbery strongly advocated the chemical view. —London *Electrician*, Sept. 17, 1915.

Units, Measurements and Instruments

Testing High-Tension Insulation.—G. BENISCHKE.—The author gives numerical examples which show how much the actual stress on the insulating material depends on the wave-form of the voltage, if the operation voltage or testing voltage is adjusted according to its effective value. From oscillographic curves it is shown how greatly the wave-form of the same machine can be changed by armature reaction so that in insulation tests using the same machine but at different loads the electric stress on the insulation may be very different. By using an eddy-current damping arrangement the wave-form can be left nearly unchanged. From oscillographic curves for the current waves of an alternating-current machine in connection with a high-voltage transformer it is found that the higher harmonics are strongly emphasized, and it is recommended that high voltages be produced, not in a single transformer but by two transformers in series.—*Elek. Zeit.*, Aug. 5, 1915.

Meters.—A. ILIOVICI.—A review of the commercial electricity meters in use in France. The principal direct-current meters are the "O. K." meter, the different magneto-electric meters with disk armature, the Thomson meter and its derivative, the Vulcain meter. Among alternating-current meters the rotary-field induction meters with revolving disk as made by different companies are described and illustrated.—*La Lumière Elec.*, Sept. 18, 1915.

Certifying Meters.—An official communication of the Reichsanstalt on the official testing and certification of electric meters. The following types are not admitted for certification: meters for non-inductive load, three-phase meters for balanced phases, meters in which with one and the same counting device the consumption for lighting and the consumption for power are counted but rated differently. The conditions under which double-tariff meters are tested and certified are stated.—*Elek. Zeit.*, July 22, 1915.

Telegraphy, Telephony and Signals

Electric Oscillation in Coupled Circuits.—W. H. ECCLES AND A. J. MAKOWER.—A paper read before Section G of the British Association for the Advancement of Seience dealing with coupled circuits of that type in which both an electric and a magnetic coupling are employed. The authors investigate the conditions under which circuits coupled electrically and magnetically may give rise to oscillations of a single frequency.—London *Electrician*, Sept. 24, 1915.

Telephone Measurements.—J. PUGET.—The first part of a mathematical paper on the calculations of the characteristic constants of telephone lines.—*La Lumière Elec.*, May 8, 1915.

Miscellaneous

Submarine Mines.—ANTOULAIEFF.—A discussion of electrical engineering problems in connection with the firing of submarine mines. The author deals in succession with the source of electrical energy, the detonator, and the station apparatus.—From *Electritchest*, translated in abstract in *La Revue Elec.*, July 2, 1915.

Trade Statistics of India.—A paper giving the imports of electrical and similar goods into British India from different countries of the world for the year ended March 31, 1913.—London *Elec. Review*, Sept. 17, 1915.

Resuscitation.—K. ALVENSLEBEN.—A paper on the physiological effects of electric currents in case of accidents and a critical review of the present methods of resuscitation.—*Elek. Zeit.*, July 29 and Aug. 5, 1915.

Book Reviews

PHYSIK. Edited by E. Warburg. Leipzig and Berlin: B. G. Teubner. 762 pages, 106 illus. Price, 24 marks.

This is one of a series of volumes bearing the generic title "Der Kultur der Gegenwart," or present-day civilization. This particular volume in the series is devoted to the subject of physics, and in particular to the fundamental principles of physics as recognized at the present time. The book discusses in turn mechanics, sound, heat, electricity, light and certain general principles. The chapters have been prepared by no less than thirty-six different and specialist authors, under the direction of the editor. The work is historical, philosophical and discursive, rather than intensive, technical or mathematical, the object being to present modern views concerning physical phenomena to the intellectual public, including technicians. There is certainly a need for a book of this sort. The names of the various authors are sufficient evidence of authentic information in each department, and the general review of physical science, obtained in almost non-mathematical form, gives the work an interest and a character of its own. For example, after a brief history of mechanics from the times of Newton, Galileo and Descartes down to the present day, the relations of relativity and thermodynamics to the modern theory are presented in a very acceptable form. The work will be welcome to scholars who are interested in modern physical views and hypotheses, if they are acquainted with the German language and with the elements of physics, mathematics and philosophy.

INTERNAL-COMBUSTION ENGINES. By Robert L. Streeter. New York: McGraw-Hill Book Company, Inc. 418 pages, 239 illus. Price, $4.

As a textbook for engineering students this work by Professor Streeter is admirably written. It starts off with a little history of the work of those who have designed internal-combustion engines and then proceeds to the theoretical side of the subject, taking up the laws of gases and thermodynamics, operating cycles, fuels, ignition, carburetion, governing, cooling and the like. These subjects occupy about one-third of the volume. The next third of the book takes up matters of a practical nature, giving the cost of power generated in plants where internal-combustion engines are used as prime movers together with brief descriptions and characteristics of a number of the successful gas-using and oil-using engines now on the market. The cost data given are well arranged to show the comparative economy of steam, producer-gas and oil-engine plants of 20-kw., 100-kw., 250-kw. and 500-kw. ratings. The last part of the book takes up the design of engines and parts and deals with those features that show the principles involved. The work is fairly free from mathematical discussions and contains a number of examples worked out in order to show the use of formulas given.

Joseph Henry in the Hall of Fame

Joseph Henry, pioneer of American science, discoverer of the principles of winding electromagnets, inventor of the first operative telegraph, discoverer of the oscillatory nature of static discharges and of the principles of inductance, and independent discoverer of electromagnetic induction—was one of six distinguished Americans to whom places were accorded last week in the Hall of Fame, University Heights, New York City, by a majority of the ninety-seven electors of the institution. Joseph Henry was born in 1799, near Albany, N. Y.; served for a number of years as professor in Princeton University; was the first secretary and director of the Smithsonian Institution, and died in Washington in 1878. In 1831, five years prior to the date usually assigned to Morse's work, Henry devised a working electromagnetic telegraph and in his lecture work at that early date employed a local relay circuit to augment the feeble incoming impulses. In 1831 he also described a form of oscillating electric motor in which a rocker arm dipping into mercury cups served as the commutator for the armature. In 1832 he accepted the professorial chair at Princeton, which institution now treasures a large collection of his early apparatus and scientific writings. In a paper read before the American Philosophical Society in 1842 Professor Henry expressed the opinion that the electrical discharge from a condenser is of an oscillatory character. His discovery of the principle of electromagnetic induction actually antedated the independent discovery of the same principle by Faraday, but Henry, with the personal modesty characteristic of many men of science, withheld the announcement of his discovery for a time, and Faraday was the first to publish his observations. Henry, in his work on mutual induction, also first revealed the inductive action between coils of different numbers of turns and showed that voltage may be stepped up or down, as in the modern induction coil or transformer. He was the first to apply the telegraph to the work of general weather reporting and prediction, by charting weather conditions on the map of the North American continent. He was for many years presiding officer of the American lighthouse board, and in connection with his government work prosecuted many independent researches on illuminants, fog signals, acoustics, building materials, etc. Foremost of American physicists, Henry was a man of broad culture and liberal views, of great gentleness and personal charm, and yet of tremendous definiteness of purpose and energy.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

F. W. Hild, general manager of the Portland Railway, Light & Power Company, Portland, Ore., has resigned from that company to become vice-president and general manager of the Denver (Col.) Tramway. Mr. Hild has been general manager of the Portland Railway, Light & Power Company since March 15, 1911, and was in charge of the railway, light and power operating departments of the company. He was formerly assistant general manager and chief engineer of the Havana (Cuba) Electric Railway. He was graduated as an electrical and a civil engineer from Union College at Schenectady, N. Y., in the class of 1898 and was for a time connected with the General Electric Company. While in the employ of this company Mr. Hild assisted in the important rehabilitation work carried out by the Twin City Rapid Transit Company, the Kansas City Railway & Light Company and the Chicago Edison Company. Mr. Hild was one of the originators of the idea of organizing an association to represent the electric railways on the Pacific Coast and was elected president of the Pacific Coast Electric Railway Association at its organization in San Francisco, Cal., on April 1, 1913. A farewell luncheon was extended to Mr. Hild on Sept. 30 by the Portland Chamber of Commerce, at which F. T. Griffith, president of the Portland Railway, Light & Power Company, paid a tribute to the ability of Mr. Hild, who replied in a fitting speech. Mr. Hild succeeds John A. Beeler with the Denver Tramway.

F. W. HILD

Dr. E. Rosenberg, who is an Austrian subject, has resigned as chief engineer of the British Westinghouse Company. Dr. Rosenberg studied at the University of Vienna, where he graduated with the degree of D.Sc. After a year in the Austrian Navy he became first designer for the Nuremberg (Germany) plant of Schuckert & Company. In 1900 he was appointed chief electrical engineer for Körting Brothers at Körtingsdorf, near Hanover, and in 1903 he was appointed chief of a department of the Allgemeine Elektricitäts Gesellschaft, Berlin. Dr. Rosenberg visited the United States in 1907. He was afterward appointed chief engineer of the British Westinghouse Company's works at Manchester. He is the author of numerous papers and works on induction motors, dynamos, cranes, train lighting, turbo-generators, etc.

W. B. Milligan, formerly of the Western Ohio Railway, has accepted a position with the Albert Emanuel Operating Company of Dayton, Ohio, and began his new duties Oct. 1.

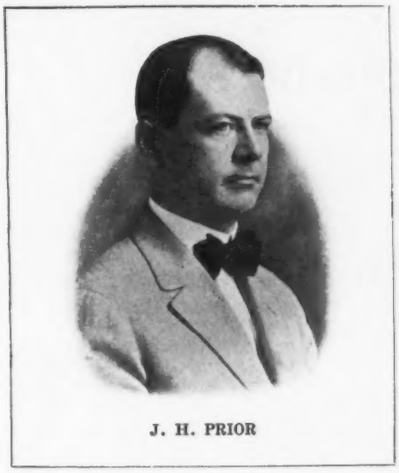
H. W. Duncan, superintendent of the Northern Indiana Gas & Electric Company, Plymouth, Ind., has been engaged as superintendent for the Waxahachie (Tex.) Gas Company.

Theodore Clauss, who has been for a number of years associated with the Union Gas & Electric Company of Cincinnati, acting as secretary of the company until about a year ago, has resigned his office with that company. He will continue as secretary of the Cincinnati Gas & Electric Company.

Percy H. Burrowes has resigned as general superintendent of the York County Power & Light Company, Portland, Me.

Peter Cooper Hewitt, best known in connection with his work on the mercury-vapor arc and one of the engineers just appointed to represent the Inventors' Guild on the Naval Advisory Board, comes from a family noted for its inventors and philanthropists. Mr. Hewitt was educated at Stevens Institute of Technology and Columbia University. Among his principal inventions have been the development of the mercury-vapor arc as a lamp, as a rectifier, and as an interrupter, and the application of rodamine reflectors for supplementing the color of the light obtained from his lamp. Mr. Hewitt's studies and publications on negative-electrode resistance and on obscure phenomena of alternating currents are of the greatest scientific importance, although a large share of his attention has been devoted to the practical development and application of his inventions. At the first meeting of the new board, held at Washington Oct. 7, Mr. Hewitt was elected vice-chairman of the board, with Mr. Edison as chairman.

PETER COOPER HEWITT



J. H. PRIOR

J. H. Prior, who has just been appointed chief engineer of the Illinois Public Utilities Commission, with headquarters at Springfield, Ill., entered the service of the Illinois commission about a year ago as assistant chief engineer. Prior to that time, during the years 1905 to 1914, Mr. Prior was engineer of design of the Chicago, Milwaukee & St. Paul Railway and was engaged in the design of all structures on that railway and on its 2000-mile extension known as the Puget Sound Lines. Mr. Prior made two of the earliest valuations of railroad properties required by railroad regulatory and taxing bodies. These were the valuations of the structures of the Chicago, Milwaukee & St. Paul Railway for the first Minnesota valuation in 1906 and the first South Dakota valuation in 1907. Mr. Prior was educated at the Armour Institute of Technology and the University of Chicago.

E. W. Ehmann has been appointed to succeed John G. Felton as chief engineer for the Fulton County Gas & Electric Company, Gloversville, N. Y.

A. W. Evans, formerly of the meter department of the Athol Gas & Electric Company, has been appointed commercial manager of the company, succeeding R. P. Benedict.

W. P. Chestnut, commercial manager for the Union Light, Heat & Power Company, Fargo, N. D., has been elected secretary-treasurer of the Merchants' Auxiliary of the North Dakota State Fair Association.

M. L. Hibbard, general manager of the Union Light, Heat & Power Company, Fargo, N. D., has been re-elected as a member of the board of directors of the Merchants' Auxiliary of the North Dakota State Fair Association.

W. M. Lewis, manager of the Grand Rapids & Muskegon Power Company, Muskegon, Mich., has been appointed district manager of the Consumers' Power Company for Michigan. Mr. Lewis' headquarters will continue to be at Muskegon.

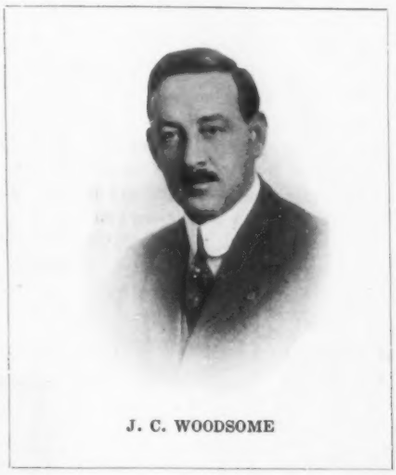
Frank E. McKee, the secretary and treasurer of the Shaw Electric Crane Company, Muskegon, Mich., has been appointed assistant to A. J. Babcock, president and manager of the factories controlled by the Manning, Maxwell & Moore Corporation.

Charles A. Russell of Gloucester, Mass., has been confirmed as a member of the Massachusetts Public Service Commission, following a recent appointment by Governor Walsh.

Charles J. Hatch, manager, and C. E. Greenwood, assistant manager, of the electrical exposition to be given in 1920 at Boston, Mass., under the auspices of the Edison Electric Illuminating Company in celebration of the three hundredth anniversary of the landing of the Pilgrim Fathers on Plymouth Rock, left Boston on Oct. 2 for a trip of about six weeks to the Pacific Coast.

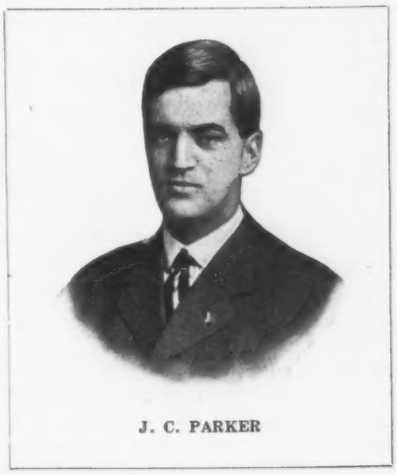
R. P. Benedict, for the past five years commercial manager of the Athol (Mass.) Gas & Electric Company, has been appointed manager of the Chicopee (Mass.) electric-lighting department, succeeding C. W. Whiting of Boston, who has been serving temporarily in this capacity. Mr. Benedict has had a varied engineering experience, starting with the Stanley Electric Manufacturing Company of Pittsfield, Mass., and later being employed by the Pittsfield Electric Company, the Northampton Electric Lighting Company, and the R. W. Parks properties at Westfield, Mass.

J. C. Woodsome, the president-elect of the Southeastern Section of the National Electric Light Association, is the general manager of the Tampa Electric Company of Tampa, Fla. Like many other men in the Stone & Webster organization, Mr. Woodsome is a native of Boston and was graduated from the Massachusetts Institute of Technology. From 1901 to 1902 he served as assistant instructor at "Tech," and in the latter year entered the employ of the Stone & Webster



J. C. WOODSOME

company. In January, 1906, he was appointed superintendent of the Houghton County Electric Light Company at Houghton, Mich., and in August, 1908, he was promoted to be superintendent of the Dallas Electric Light & Power Company at Dallas, Tex. Since May, 1911, Mr. Woodsome has held his present position of general manager of the Tampa Electric Company. He is a director of the Tampa Rotary Club and the Tampa Board of Trade and holds membership in a number of national engineering societies.



J. C. PARKER

John C. Parker has resigned as mechanical and electrical engineer of the Rochester (N. Y.) Railway & Light Company to become professor of electrical engineering at the University of Michigan, Ann Arbor. Mr. Parker was graduated from Michigan in 1901 and since 1910 has been non-resident lecturer there on the subjects of electric-power transmission and distribution. He was formerly assistant to the engineer in charge at the plant of the Ontario Power Company, Niagara Falls, Ont., and while in this connection had much to do with the construction and transmission line of the Niagara, Lockport & Ontario Power Company, also designing and installing the systems of receiving stations and substations for delivering 60,000-volt Niagara energy to the plant of the Lackawanna Steel Company. Afterward he designed the transmission line and system for bringing Niagara energy to Rochester, N. Y. In recent years Mr. Parker has devoted much of his time with the Rochester company to the study of the general economics of power generation, distribution and sale.

F. R. Fowles, who has been appointed general superintendent of the York County Power & Light Company, with headquarters at Biddeford, Me., was formerly in the employ of the Tennessee Power Company at Chattanooga, Tenn. Mr. Fowles was graduated from the University of Michigan in 1906 with the degree of mechanical engineer and following this joined the staff of the General Electric Company at Schenectady, N. Y.

Obituary

Isaac B. Hammond, organizer of the Union Electric Company of Portland, Ore., and prominent manufacturer of that city, died in Portland Sept. 22 at the age of seventy-one years. His death was due to hardening of the arteries and to a complication of diseases. Practically all of Mr. Hammond's life had been spent in the manufacture of electrical and mining machinery, and at the time of his death he was president and owner of the Hammond Manufacturing & Electric Company of Portland and was active in local civic affairs.

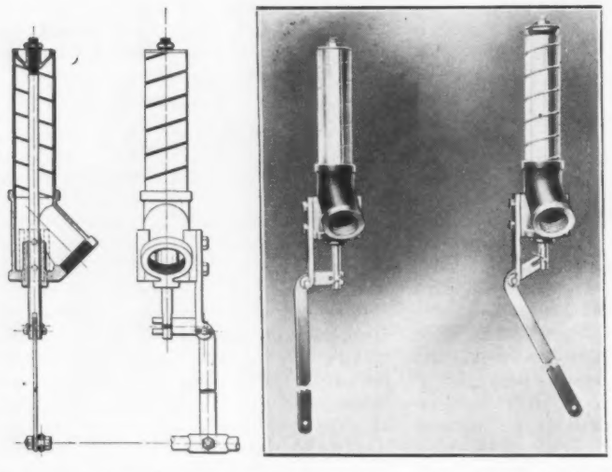
New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

A New Spray Head for Cooling Ponds

A spray head designed and patented by Prof. Carl C. Thomas of Johns Hopkins University and placed on the market by the C. H. Wheeler Manufacturing Company, Philadelphia, Pa., is shown in section in Fig. 1. This spray head distributes the water by spreading a film of water which overcomes the surface tension and produces an infinite number of fine drops. It consists essentially of a cast-iron supporting base, on which is mounted a bronze tube cut in spiral form as shown. The spiral tube is held between the base and a cap which fits in the top, the cap being screwed to a central bronze stem which passes down through a close-clearance bushing in the base and is operated by a bell crank with an extended vertical arm, giving accurate control, it is declared, of the position of the stem. A very small movement of the stem will vary the opening of the spiral, as it compresses or releases by the vertical travel of the cap. This adjustment in turn controls the fineness of the film of water. When in operation, the water leaves the spray head in a continuous sheet in an upward direction, owing to the angle of the spiral openings. As the film spreads it becomes thinner, because of the increasing diameter, until the surface tension is overcome, at which point, it is asserted, the water breaks into a uniformly fine spray.

The adjustable feature provides a means of varying the thickness of the film of water and the fineness of the spray. The spray may also be regulated to suit the load and the quantity of water at varying atmospheric conditions. A coarse spray, therefore, may be employed during periods of high-wind velocity, thus minimizing driftage. When there is little or no wind and cooling conditions are unfavorable, by closing the spirals the spray can be made very fine, thereby greatly increasing the exposed surface of the water particles to the action of the air, which in turn creates higher evaporation and reduces the water much nearer to the theoretical temperature desired. In Fig. 3 the head is shown in its operating position with the spiral compressed to an average opening. In Fig. 4 the spray head is in an open position with the cap elevated and clearing the top of the spiral. On account of the adjustable feature, foreign matter, such as leaves, weeds, twigs, etc., which tend to collect in a spray system, may be readily washed out by momentarily raising the adjusting cap, releasing the tension on the spiral, and flushing the foreign matter out. A pressure varying from 2 lb. to 4 lb. per square inch is required for forcing the water through the annular opening of the head.



FIGS. 1, 2, 3 AND 4—SPIRAL SPRAY HEAD

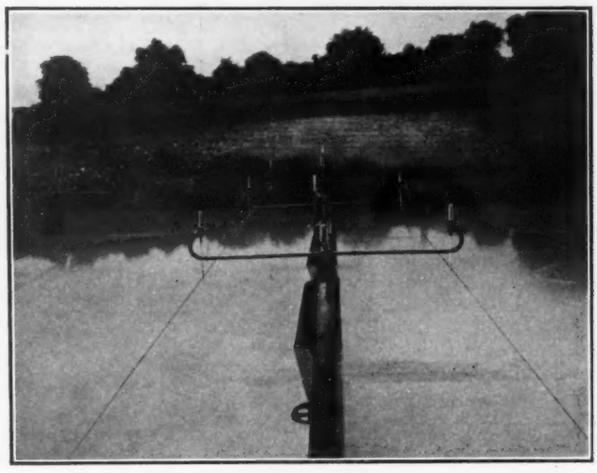


FIG. 5—INSTALLATION OF SPIRAL SPRAY HEADS

Automobile Searchlamp with Outside Focusing Adjustment

A recently developed automobile searchlamp known as the "Pittsburgh Five" is provided with an outside set-screw focusing adjustment which permits, it is declared, the use of any style of vacuum or nitrogen-filled lamp, regardless of size or voltage, and makes it possible to adjust the lamp instantly for any kind of beam without disturbing it in any way or removing it from its position. By means of this adjustment it is said that the lamp can be transferred from one car to another of different voltage at will. The adjustment also enables the user to select a bulb to suit his requirements and, in case of accident, to use any available bulb

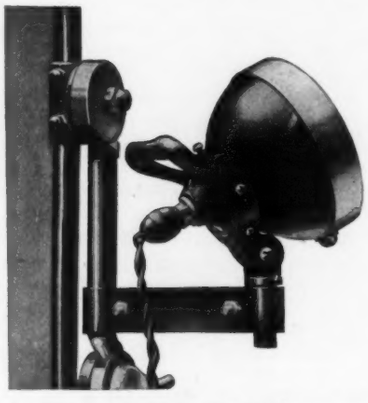


FIG. 1—SEARCHLAMP WITH FOCUSING ADJUSTMENT

as a renewal. Should it become necessary to use the searchlamp in the place of a headlamp, the width of the illuminated field can be increased, it is declared, if desired. A feature of the device is the double curvature

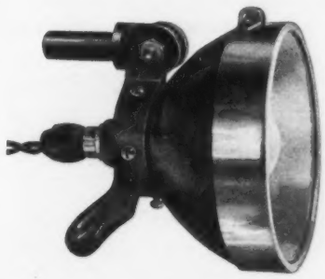


FIG. 2—LAMP WITH HANDLE USED AS STAND

parabolic reflector, which, though only 5 in. in diameter, distributes the light evenly. The device is equipped with a handle which can be employed as a stand for holding the lamp in an upright position when detached for repairing tires, etc., as shown in Fig. 2. The lamp is being made by the Pittsburgh Electric Specialties Company, Pittsburgh, Pa.

Electric Water Heater for Soda-Fountain Service

An interesting device which has been developed especially for bar and soda-fountain service is the ornamental electric water heater shown herewith. The heater has a capacity of 4 qt., the reservoir being of crystal lead glass which is frosted to make the water line dimly visible. The globe is held in place by removable stay rods. When used as an instantaneous heater water is retained in a well connected directly with the faucet. Automatic check valves regulate the circulation so that the heat is concentrated around the water in the well at the point where it is drawn off. Two heats are provided. At high heat the water can be brought to a boiling point, it is asserted, in about sixty seconds. At low heat the device takes 95 watts and keeps the water at a temperature just below boiling. The heater is 7.5 in. by 7.5 in. at the base and is 15.75 in. high. It is provided with a separable attachment

FOUR-QUART ELECTRIC WATER HEATER

plug which fits any ordinary lamp socket. The device operates on either direct current or alternating current at a pressure ranging from 100 volts to 130 volts. It can be easily taken apart, cleaned and set up again in a few minutes. When the high heat is turned on, the pilot light in the base is dim. On low heat the light is bright. Illuminated red-and-blue lettering is sandblasted into the glass panels of the base. In case the low heat is left on all night, it is declared, the heater will not boil dry. Even if high heat is left on and the water boils away, the manufacturer also claims, the heating element will not burn out. The heater is being made by the International Electric Company, Indianapolis, Ind.

First-Aid Belt

A handy first-aid belt for workmen who are liable to be injured or suffer from shock or asphyxiation while performing hazardous duties has been developed by J.

FIG. 1—CANVAS COMPARTMENTS FOR CARRYING REMEDIES

S. Parker, superintendent of the Frankford district, for the United Gas Improvement Company, Philadelphia, Pa., at the suggestion of H. B. Christy, foreman fitter of the same district. The belt is of leather and is provided with heavy canvas compartments, as shown

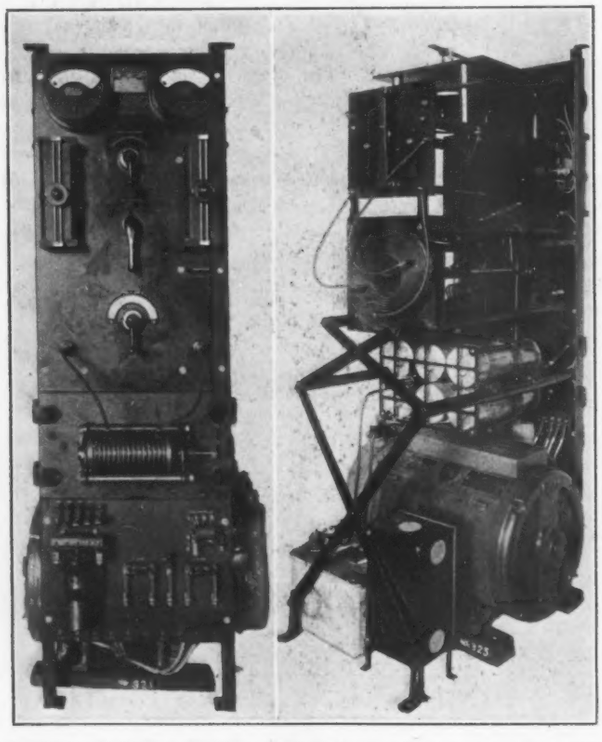
FIG. 2—FIRST-AID BELT IN PLACE WITH LAPELS CLOSED

in Fig. 1, in which can be placed various remedies and instruments for first-aid treatment. There are four compartments, and each of these is provided with a lapel which closes with a catch button. The outfit is especially useful, it is declared, for complaint men, who often find themselves in situations where restoratives are immediate necessities.

Commercial Wireless Apparatus

To meet the requirements of increased traffic and strict government supervision a new standard 2-kw., 500-cycle panel radio set has recently been developed for commercial purposes by the Marconi Wireless Telegraph Company of America, 165 Broadway, New York. The apparatus has been designed especially for use on ships, and is said to provide increased facilities for transmitting and receiving messages in congested waters such as in New York Harbor and other ports. The set is of the noiseless quenched-gap type and therefore, it is claimed, does not disturb the passengers whose quarters are near the wireless cabin. Because of the fact that all of the apparatus is mounted on a panel a minimum amount of space is required, a feature which is of considerable advantage on coastwise craft. Emphasis is placed by the manufacturer on the standardization features of this equipment, the advantages of which are considerable. It is claimed that the efficiency of the operators handling standard equipment will be greater than that of those handling several types of apparatus.

The complete set consists of a transmitting and receiving apparatus and various switches and appliances for manipulating the equipment. The panel-type transmitter has all of the regulating and manipulating appliances mounted on the front so that they are easily accessible. Means are provided so that impulses of three wave-lengths, 300 meters, 450 meters and 600 meters, can be transmitted, the change of wave-length being accomplished by throwing a switch to the desired position. On the front of the panel are mounted a wattmeter, which indicates the amount of energy consumed at the terminals of the transformer; a radiation meter,



FIGS. 1 AND 2—FRONT AND BACK VIEWS OF COMPLETE TRANSMITTER

which indicates the energy flow in the aerial circuit; a motor field rheostat, which enables the speed of the motor-generator to be varied; a generator field rheostat, which permits the variation of the generator voltage; an aerial inductance handle, which permits the variation of inductance in the aerial circuit and indicates the amount in turns; a wave-length switch, a handle which permits the variation of coupling between the closed and aerial circuits, and a low-power switch which permits transmission at extremely low power in order to reduce interference to a minimum. Beneath the panel is another panel which contains the quenched-spark gap.

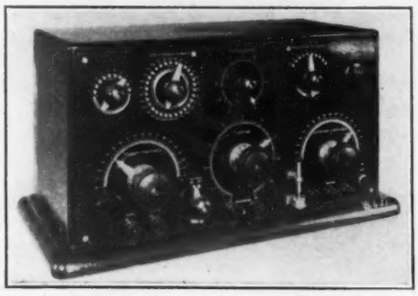


FIG. 3—FRONT VIEW OF RECEIVING SET

The latter panel is mounted on hinges so that it can be opened from either side for the purpose of removing and replacing the condenser jars.

The quenched gap is cooled by an air blast delivered from the combined rotary gap and blower mounted on the end of the motor-generator. Beneath the quenched spark-gap is placed the starting panel, on which are mounted all the starting appliances, control switches and protective devices. A number of posts or lugs are also mounted on this panel, permitting the external connections to be made without difficulty. An automatic starter enables the motor to be started from a distant point by means of a single-pole switch. The starter cuts out three steps of resistance when starting and energizes the generator field when the motor is up to full speed, thus preventing the operation of the set until all resistance of the starter is cut out. When the control switch is opened the starter automatically connects a resistor across the motor armature terminals, which quickly brings the motor-generator to a stop.

The elements of the high-frequency circuits are mounted back of the transmitting panel and supported on insulating rods. The inductance coils are of spiral form and consist of a "bakelite dilecto" slab having a spiral groove cut in one face. Into the spiral groove is fitted a strip of copper of the desired number of turns. The closed oscillating circuit consists of an inductance called the primary, a condenser consisting of six jars having a capacity of 0.002 microfarad each, the quenched spark-gap, the rotary spark-gap and the wave-length switch. All of these elements are connected in series. A switch permits either the rotary spark-gap or the quenched gap to be connected in the circuit. The wave-changing switch is controlled by the handle on the front of the panel and, when in the 300-meter position, three jars, or half of the total capacity, are connected in the circuit.

The aerial circuit consists of the antenna, the aerial inductance, which is varied by means of the handle on the front of the board; a loading inductance, which permits contact to be made at any point, and a secondary inductance, as it is called. All of the elements are connected in series to the ground through the thermo junction of the radiation meter. The primary or the inductance of the closed circuit can have its distance from the secondary varied by means of a handle marked "coupling," permitting variations in the mutual inductance between the two circuits. A wave-length-changing switch is also inserted in the aerial circuit, which is controlled by the handle on the front of the board. The handle controls both the primary and secondary switches so that one operation not only connects

in the proper amount of inductance and condenser in the closed oscillating circuit and the aerial circuit but also permits the change of wave-length and still maintains the proper coupling between the two circuits without varying the distance between the primary and the secondary. When operating on the quenched gap the

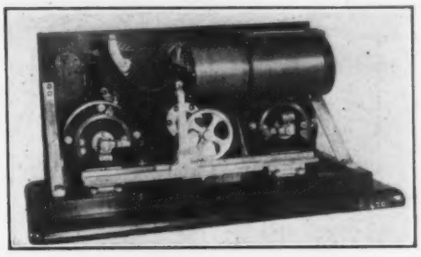


FIG. 4—REAR VIEW OF RECEIVING SET

distance between the primary and the secondary is very short and is kept constant.

The receiving set is made up of a type 106 tuner with a crystal detector. The tuner consists essentially of a variable inductance which is placed in series with the antenna and the ground. This inductance is called primary. A small variable condenser is also in series with this circuit, being used to shorten the natural period of the aerial so that signals of short wave-length can be received. When this condenser is not needed, it is turned to the "off" position, where it short-circuits itself. The closed circuit consists of a variable inductance and a variable condenser in series. The variable inductance is movable relative to the primary so that the coupling between the two circuits can be varied. In shunt with the variable condenser of the closed circuit there is a potentiometer, with the detector and a condenser, all in series with each other. The telephones are connected in shunt to the last-named condenser. A battery provides the necessary energy for operating some types of crystals. Fig. 3 shows a front view of the complete receiving set.

An antenna switch, while in receiving position, throws the receiving circuits into operative condition and at the same time opens the primary circuit of the transformer and the generator field and stops the motor-generator. When the switch is thrown into transmitting position, the last-named circuits are closed and the motor-generator is started. The receiving circuits are

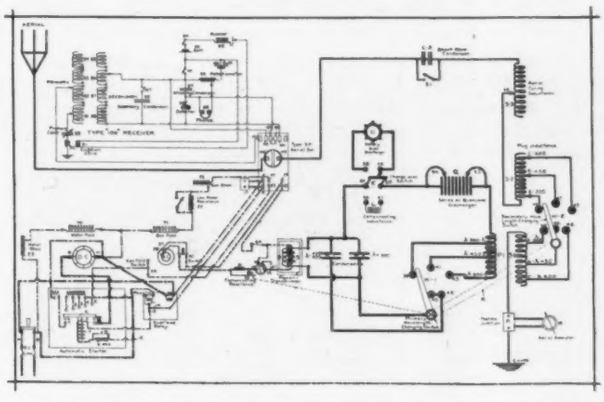
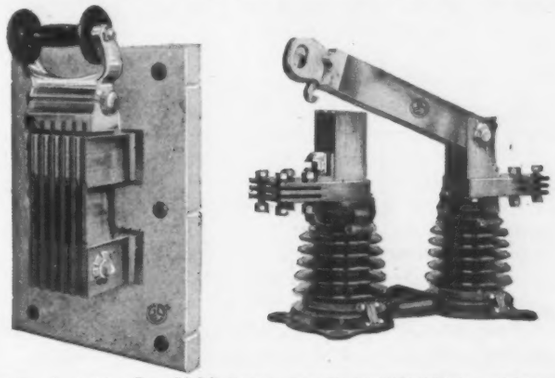


FIG. 5—DIAGRAM OF CONNECTIONS OF COMPLETE SET

automatically short-circuited in order to protect them from the transmitter. A single-pole switch, when closed, keeps the motor-generator running continuously. A key of special construction permits the opening and closing of the transformer circuit in accordance with the signals to be sent. Fig. 4 shows a diagram of connections of the complete set. In the majority of installations a storage battery is used so that the set can be operated independent of the ship's power. A 0.5-kw. set, which is similar in all essentials to the 2-kw. equipment, has also been designed by the Marconi company. It is intended for use on smaller vessels and as an auxiliary set on large craft.

Switch and Bus-Support Equipment for Large Plants

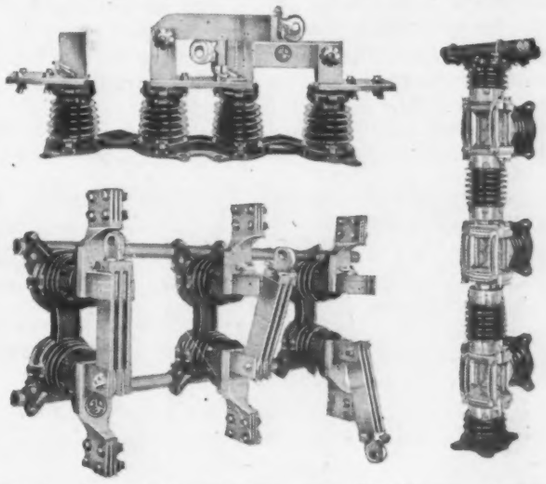
The General Devices & Fittings Company, 817 West Washington Boulevard, Chicago, Ill., has recently developed some interesting switch and bus-support equipment for three large power plants, some of which is shown herewith. The devices have been designed for a plant with large-sized generating units, and special care was necessitated in the manufacture to provide reliable



FIGS. 1 AND 2—6000-AMP. BACK-CONNECTED SWITCH AND 2000-AMP. GENERATOR BUS SWITCH

and safe operation. The switches were designed for a certain minimum millivolt drop. Copper forgings were used throughout.

In Fig. 1 is shown a front view of a back-connected positive-lock-type switch with a rating of 6000 amp. and 600 volts for sixty-cycle operation. According to the manufacturer, the switch is the first device of its



FIGS. 3, 4 AND 5—SWITCH FOR 30,000-KW. TURBINE, TRIPLE-POLE LOCKING SWITCH, AND THREE-PHASE BUS SUPPORT

type provided with a positive lock which is thrown in or out with the switch handle. The studs are milled from solid copper forgings and are slotted 7 in. deep for bus insertions. The studs can also be slotted for vertical buses. All contacts are grounded to reduce the millivolt drop to the lowest possible point. All hard-

ware, bolts, nuts, spring washers, etc., are of phosphor bronze, turned from solid rods. The clips are of Sigamond spring copper and the blades of hard-drawn blading copper. The handle fork and entire lock are of Hertz non-magnetic metal, and the handle is of black fiber made from rings turned to size and treated.

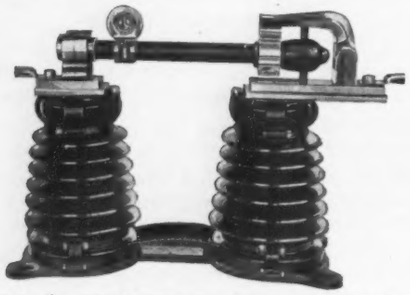


FIG. 6—DISCONNECTING-TYPE SUPPORT FOR 15,000-VOLT FUSE

Switches of the type shown are being made in sizes with ratings up to 16,000 amp. Those rated above 10,000 amp. have double cushion locks and interferences.

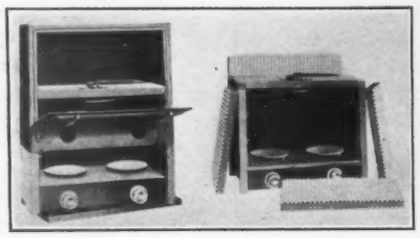
In Fig. 3 is shown a special generator switch designed for a 30,000-kw., 13,200-volt turbine which is equipped with positive lock and throw-over interference. The bridge base is a continuous unit. A generator bus switch rated at 2000 amp. at a pressure of 15,000 volts is shown in Fig. 2. It is mounted on a malleable-iron bridge base.

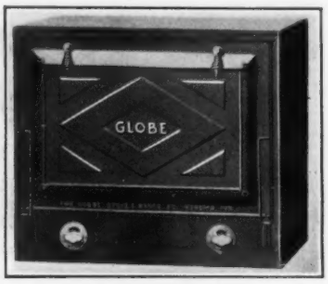
A triple-pole locking-switch equipment mounted on a horizontal pipe frame is shown in Fig. 4. Switches of the type shown are rated at 2000 amp. at a pressure of 600 volts for operation on sixty-cycle energy. They are equipped with interference locks. The bridge bases permit of vertical adjustment, and barriers are provided between switches. In Fig. 6 is shown a disconnecting-type support for a 15,000-volt expulsion fuse. Supports are also being built for cartridge-type fuses and are mounted on bridge bases if desired. Either flat or pipe mounting may be utilized. A three-phase bus support for 600-volt service is shown in Fig. 5. All metal parts except the base are of Hertz non-magnetic metal, the bolts being of phosphor bronze. Supports of this type are being made in various sizes and for various voltages and to support as many as nineteen bars 0.25 in. by 10 in. in size. The support is adjustable and weighs 320 lb. Another type of support is shown in Fig. 7. It is designed for 3.5-in. copper tubing insulated for 13,200 volts. It is adjustable and can be removed from the bus when the latter is energized. In Fig. 8 is shown a single support designed to take one phase leg from the big support shown in Fig. 6. It is designed for mounting on two parallel pipes and to clamp the bus.

FIGS. 7 AND 8—SUPPORT USED WITH TUBING, AND PHASE-LEG SUPPORT

Unit-Part Electric Range

Electric ovens and hot-plates so designed that they may be easily combined in frames to form complete electric ranges are now being marketed by the Globe Stove & Range Company of Kokomo, Ind. The unit principle of construction embodied in this "built-up" range is analogous to that employed in building sectional bookcases. The advantage of this type of construction, as pointed out by the manufacturers of the range, is that either the oven or the hot-plates may be sold separately to act as an entering wedge for electric cooking in the home, just as the electric-service cabinet boards have been used to act as a humble beginning.





FIGS. 1 AND 2—METHOD OF APPLYING CORRUGATED ASBESTOS HEAT INSULATOR, AND OVEN, WHICH IS A COMPLETE UNIT

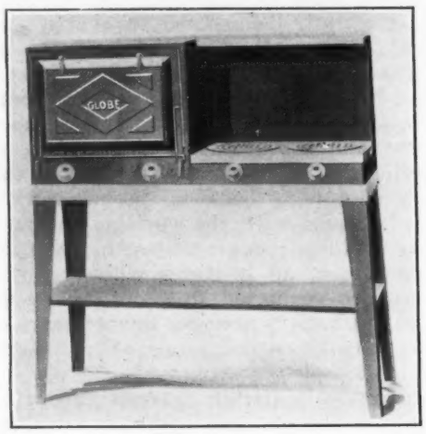
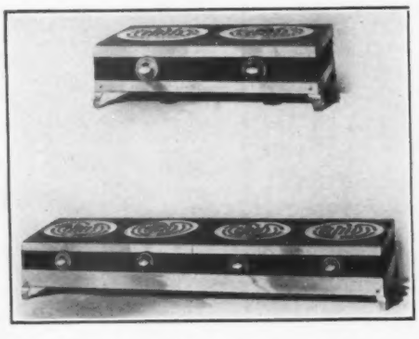
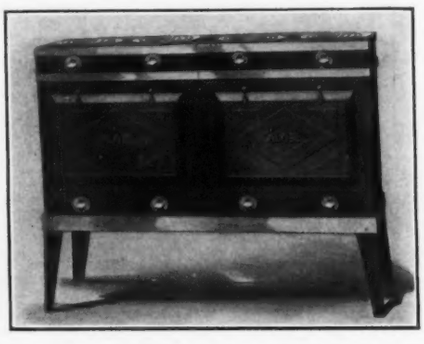


FIG. 3—A SINGLE OVEN AND HOT-PLATE COMBINED WITH A SINGLE FRAME TO MAKE A RANGE

The 18-in. by 12-in. by 12-in. oven is equipped with three totally inclosed 500-watt heating units, two of which are in the bottom of the oven, while the third is secured to the top of the oven to provide even heat distribution. Corrugated asbestos 1.5 in. thick is used on the oven walls for heat-insulating material.





FIGS. 4 AND 5—THE HOT-PLATE, WHICH IS A COMPLETE UNIT, AND DOUBLE OVEN AND DOUBLE HOT-PLATE RANGE

On the hot-plates, which are constructed to fit with the oven in the iron range frame (Figs. 4 and 5), the heating elements are of the combination open-inclosed type. The resistor used in winding all the heating coils is No. 18 chromel wire.

Electric Washer with Vacuum Plunger

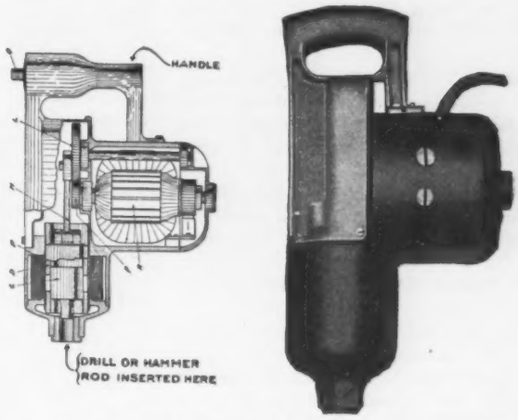
With the electrically operated washing machine shown herewith rubbing is entirely eliminated and wear and tear on the clothes are reduced, it is declared, to a minimum. Two vacuum plungers move up and down inside the tub at the rate of sixty times a minute, revolving above the water and thereby reaching all parts of the tub. On the down stroke of the plunger air is

ELECTRIC WASHING MACHINE EQUIPPED WITH TWO VACUUM CUPS

compressed and forces the soapy water through the mesh of the clothes, while on the up stroke the plunger reverses the operation, sucking the water through the mesh. The entire machine is of metal, and it can be readily moved from place to place on casters provided for the purpose. The machine is being placed on the market by the Frantz-Premier Company, Cleveland, Ohio, and both washer and wringer are operated by a 1/6-hp. Westinghouse motor.

Electric Hammer

The electrically operated hammer shown herewith consists essentially of a motor, a drill or hammer, and a magnetic clutch. A cylindrical sleeve *D* (Fig. 1), with two relatively thick end sections joined together by a thin center section, is connected to the motor *R* through hardened gears *P* and *L* and connecting rod *H*. The plunger *C*, which delivers the blow to the drill, lies loosely within the cylinder and is not mechanically connected to any part of the mechanism. Outside of the sleeve is the magnet coil *F*. This coil, which is in series with the motor, is stationary, the sleeve moving back and forth within it. The circuit is closed by means of the button *O* in the handle. The solenoid when energized creates a magnetic circuit with the thick sections of the sleeve as the poles and the plunger as the armature. As the sleeve is moved back and forth by the motor the plunger moves with it and operates the drill or hammer. The plunger is slightly longer than the



FIGS. 1 AND 2—HAMMER OPERATED BY SERIES-WOUND MOTOR

thin section of the sleeve, giving it a certain amount of over-travel and thereby removing the strain and jar of the blow from the machine. The motor is series-wound and the gears are of oil-hardened special gear steel. Ball bearings are used throughout. The hammer is being placed on the market by the Western Electric Company, 463 West Street, New York.

Lamp Grips

To overcome the trouble and inconvenience sometimes experienced with lamps and sockets when installed in places subject to vibration, causing the lamps to unscrew or "back off" from the base contact so that the circuit is broken, and often even causing the lamps to fall out, the Bryant Electric Company, Bridgeport, Conn., has developed the lamp grip shown herewith. The threaded copper portion which receives the lamp is slotted on two diametrically opposite sides in such a manner as to provide two tongues which are flexible. Two flat steel springs are mounted in the porcelain base

GRIP IN LAMP SOCKET TO PREVENT LAMP FALLING OUT

with the free ends arranged so as to bear on the outside of the copper tongues. Without any external adjustment or any other labor than the insertion of the lamp, sufficient tension is brought to bear upon the lamp base to prevent vibration from causing the contact to break.

Multiphase Currents

Miscellaneous News Items Picked from the Happenings of the Industry

Where the Schoolroom Chalk Comes From.—The American Crayon Company, the largest producer of school and industrial crayons in the world, has just installed central-station equipment in its factory at Sandusky, Ohio, replacing the isolated plant formerly in operation there. Energy is purchased from the Sandusky Gas & Electric Company.

Engineering Students at University of Illinois.—More than 1000 students are registered in the engineering courses at the University of Illinois, Urbana, for the new school year. Of this number 259 are taking the course in electrical engineering, 239 chemical engineering, and 44 railway engineering. These figures do not include the engineering students registered in the graduate school.

Flood Lighting of McKinley Monument at Canton, Ohio.—Citizens of Canton, Ohio, the home of President McKinley, are planning to have projector lamps installed to light the dome of the McKinley memorial at Canton, beneath which is the tomb of the President. It is proposed to install flood-lamp projectors on buildings near by and to illuminate the dome of the monument, rendering it visible from all parts of the city.

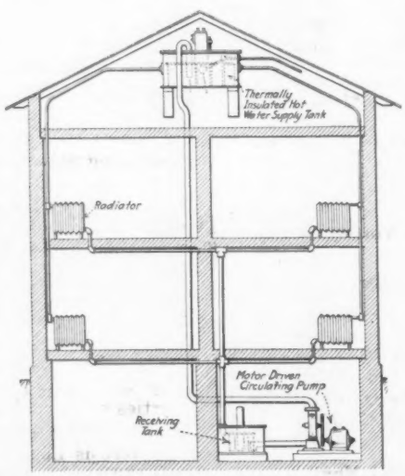
Electric Motors for Draining Marshland.—In Holland, marshland, shallow lakes and other areas covered with water are being drained by motor-operated centrifugal pumps. As the motors are equipped with float switches which start the pumps as the water level rises, there is eliminated the constant attendance required where windmills, steam engines or internal-combustion engines are used as prime movers. About fifty-three large marsh tracts, each with its own pumping equipment, are now supplied from two 3000-volt distribution systems. A number of community electric pumping plants are also employed for such drainage work.

Experimental Lectures on Electrophysics.—Prof. W. S. Franklin, who resigned recently as head of the physics department of Lehigh University and who is author of a number of books on electrical engineering, will make a tour of the universities and technical schools of the South and West during this fall and winter, when he will deliver a series of theoretical and experimental lectures on the topics of oscillatory motion, electric waves, mechanical analogies of electricity and magnetism, phenomena of motion, and educational problems of industrial communities. Professor Franklin's address during October and November will be in care of Columbia University, New York City.

Capitalization of Electric Utilities in Japan.—According to a report recently published by the Bureau of Electricity in the Department of Communications at Tokyo, electric enterprises in Japan at the end of May numbered 615, the combined capitalization amounting to more than $300,000,000 United States currency. In comparison with the end of 1914 there is an increase of fourteen in the number of enterprises and $541,475 in their combined capitalization. Power companies are in the majority, being 524 in all, with a combined capitalization of approximately $155,000,000. Railway companies number forty-four, with a combined capitalization of over $25,000,000. Others number forty-seven, with a combined capitalization of a little more than $123,000,000. The total rating is estimated at 727,783 kw., being an increase of 7551 kw. over that at the end of last year.

Polarization of Leclanché Cells Caused by Liberation of Ammonia?—Experiments conducted by Ernest G. Crocker of the graduating class in electrochemistry at the Massachusetts Institute of Technology, Boston, seem to indicate that polarization in Leclanché cells is not due to a film of hydrogen surrounding the carbon element, as commonly believed, but is caused by the alkaline action of ammonia liberated in the cells. Tests conducted with different-sized grains of materials used in dry-cell construction showed that the most suitable fineness is between 0.025 in. and 0.01 in. and that the two constituents, generally carbon and pyrolusite, should be of the same fineness, the quantity of pyrolusite being about 60 per cent of the bulk of the entire mixture.

Heating Houses by Electricity in Sweden.—In Sweden, where the price of electrical energy is low, Hjalmar Lofquist of Stockholm is introducing an electric hot-water heating system for houses of four to ten rooms. A thermally insulated water tank in which electric heating elements are installed is placed in the attic, and the water in this tank is heated at night, when the rates for electrical energy are low. In the morning the heating elements are disconnected by an automatic switch which simultaneously starts a motor-driven water-circulating pump. Hot water is then conveyed through the pipes to the radiators mounted in the rooms to be heated, and thence it flows back through a common return pipe leading to a small tank in the cellar, from which it is pumped again to the upper tank. The circulation of the hot water is thus continuous. With a heat-insulated tank of 132 gal. capacity and 4 kw. in heating units in operation ten hours per day it is claimed the water will absorb 74,800 calories, an amount of thermal energy said to be sufficient to heat four or five rooms. The cost of heating a room by this method with electrical energy at 1 cent per kilowatt-hour is given as about 12 cents for a normal winter day. By changing the number of electric heating units in service the system can be adjusted to weather conditions. The system is designed for use only where the cost of electric energy is low or where low rates can be obtained at night.



THE WATER IS HEATED IN THE ATTIC TANK DURING THE NIGHT, AND IN THE MORNING A CLOCK SWITCH CUTS OFF THE HEATERS AND STARTS THE MOTOR WHICH DRIVES THE CIRCULATING PUMP

Artificial Geysers Break Forth in Fifth Avenue.—Fifth Avenue at Fifty-third Street, New York City, took on some of the volcanic aspects of Yellowstone Park one evening this week when steam escaping from an underground general-service main of the New York Steam Company broke through the pavement in a number of places and spouted from 50 ft. to 60 ft. in the air Lumps of mud-stone were carried up with the steam and fell pattering on the pavement in all directions, and the cover of a manhole in the middle of the avenue was blown off. Condensing in the cold night air, the steam fell as water, drenching the fashionable evening clothes of many persons of the neighborhood who were attracted by the curious spectacle. Traffic was held up on the thoroughfare for almost an hour.

Electric Service Rules of Commonwealth Edison Company.—Under the title "Rules and Information Pertaining to Electric Service, Meters, Wiring and Motors," the Commonwealth Edison Company, Chicago, has lately issued a useful eighty-six-page booklet to acquaint customers, contractors, architects and engineers with the company's requirements relating to the installation of service connections, meters, motors, etc. All registered electrical contractors in Chicago have been provided with copies of these rules, which are supplementary to the electrical code of the city of Chicago and do not intentionally conflict with that code in any respect. Information concerning the character of the electric service in different parts of the city and the appropriate size and arrangements of meters and cut-outs is included in the booklet for the convenience of customers and contractors. One-half of the book is taken up with dimensioned drawings and diagrams of meter-board mountings, etc.

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Associations and Societies

Philadelphia Jovians.—The Oct. 7 meeting of the Jovian Electrical League of Philadelphia was addressed by Charles J. Cohen, president of the Chamber of Commerce. The subject was "Philadelphia."

Chemical Engineering Society Meeting.—At the Oct. 21 meeting of the Chemical Engineering Society, to be held in Pittsburgh, S. T. Snyder will talk on "The Electric Furnace for High Temperatures in Chemical Work."

Cleveland Electrical League.—At the Oct. 14 luncheon of the Electrical League of Cleveland Victor W. Sincere, general manager of the Bailey Company of Cleveland, made an address on "The Attitude of the Business Man Toward Civic Affairs, and Digressions."

National Association of Railway Commissioners Convention.—At the annual convention of the National Association of Railway Commissioners, which began on Oct. 12 in San Francisco, Clifford Thorne, the president of the association, in his opening address made a vigorous defence of State regulation.

Schenectady Section, A. I. E. E.—The Schenectady (N. Y.) Section of the American Institute of Electrical Engineers opened its tenth season on Oct. 12 at Edison Club Hall. J. J. Carty, chief engineer of the American Telephone & Telegraph Company and president of the Institute, was the speaker of the evening.

Meeting of Ohio Commercial Men at Middletown.—The next meeting of the committee on new-business co-operation of the Ohio Electric Light Association will be held at Middletown, Ohio, Nov. 17. J. E. North, who is chairman of the committee, is the contract agent of the Springfield Light & Power Company, Springfield, Ohio.

Los Angeles Jovians.—At the Oct. 6 meeting of the Jovian League of Los Angeles an address was given by C. E. Sebastian, Mayor of Los Angeles. Morris M. Ferguson spoke on "The Measure of a Business Man." The committee in charge of the meeting to be held on Oct. 21, Edison Day, is preparing a special program for the celebration of that occasion.

Change in Meeting Date of Jobbers' Association. — The next quarterly meeting of the Electrical Supply Jobbers' Association will be held at the Homestead Hotel, Hot Springs, Va., on Nov. 17, 18 and 19, instead of Nov. 16, 17 and 18, as earlier announced. Franklin Overbagh, 411 South Clinton Street, Chicago, Ill., is general secretary of the association.

Pittsburgh Section, A. I. E. E., October Meeting.—The October meeting of the Pittsburgh (Pa.) section of the American Institute of Electrical Engineers, held at the Seventh Avenue Hotel on Oct. 12, was opened with a dinner, following which R. H. Marvin, electrical engineer with R. Thomas & Sons, East Liverpool, Ohio, presented a paper on "The Manufacture and Testing of High-Voltage Porcelain."

New York Section, I. E. S.—The October meeting of the New York Section of the Illuminating Engineering Society was held at the United Engineering Societies Building on Oct. 14, at which time Lieut. C. McDowell of the Brooklyn Navy Yard and Capt. E. Ardery of the Engineers' Corps, U. S. A., discussed the subject of "Illumination in the Army and Navy." Preceding the meeting a dinner was held at Keen's Chop House.

Southwestern Convention at Galveston Again Next Year.—The twelfth annual convention of the Southwestern Electrical and Gas Association will be held at Galveston, Tex., May 17 to 20, 1916, the Hotel Galves being the headquarters as heretofore. Following the recent Gulf Coast storm, H. S. Cooper, secretary of the association, and also engineer in charge of the construction of the Hotel Galves, visited the hotel. He reports the structure intact and giving regular service, and conditions nearly normal again in the island city.

Meeting of Technical Publicity Association.—A meeting of the Technical Publicity Association was held on Oct. 14 at the Hotel Martinique, New York City, to consider the marketing of a technical product in the export field. Don D. G. Montt, manager of Babson's South American Service, talked on "The Truth About South America." His address was illustrated with stereopticon views. George H. Richards, manager of the foreign department of the Remington Typewriter Company, discussed the kind of publicity needed in foreign fields.

Detroit Engineering Society.—The Detroit (Mich.) Engineering Society was addressed on Oct. 15 by Prof. Edward Orton, Jr., dean of the engineering department of the Ohio State University and manufacturer of standard pyrometric cones, on the subject of "Refractory Materials." Professor Orton discussed the chemical reasons governing selection of materials, the testing of refractories, plans for standardization of refractories, and the uses of refractory materials. His lecture was illustrated with lantern slides. A special meeting of the society has been called for the evening of Oct. 29, at which time Horace M. Allen, who was envoy extraordinary and minister plenipotentiary of the United States to Corea from 1897 to 1905, will speak on "Corea—Past and Present." Mr. Allen spent twenty-three years in Corea and three years in China. His address will be illustrated with numerous lantern slides.

Program of Association of Railway Electrical Engineers.—The eighth annual convention of the Association of Railway Electrical Engineers will be held at the Hotel LaSalle in Chicago, Oct. 18, 19, 20, 21 and 22. Following the address of President H. C. Meloy of the New York Central Lines, standing committees will report on reciprocal relations, loose-leaf binders for filing specifications to keep specifications and standards to date, data and information, specifications for wire crossings, standards for train-lighting equipment, electric headlamps, wireless telephone and telegraph as applied to moving trains, industrial trucks, wire specifications, metal-conduit specifications, standard rules for car wiring, rating of train-lighting lamps, illumination, standardization of crane, turntable and transfertable motors, compressed-air generation, and shop practice. J. A. Andreucetti of the Chicago & Northwestern Railway is secretary of the associtaion.

Program for St. Louis Meeting of A. I. E. E.—At the 314th meeting of the American Institute of Electrical Engineers, which will be held in St. Louis, Mo., Oct. 19 and 20, the following papers will be presented: "The Repulsion-Start Induction Motor," by J. L. Hamilton; "Single-Phase Squirrel-Cage Motor with Large Starting Torque and Phase Compensation," by Val A. Fynn; "Calculation of Long-Distance Transmission Lines Under Constant Alternating Voltage," by George R. Dean; "Municipal Co-operation in Public Utility Management," by Philip J. Kealy; "Automatic Control," by C. W. Place; "Recent Results Obtained from Preservative Treatment of Telephone Poles," by F. L. Rhodes and R. F. Hosford; "The Engineering Experiment Station of the University of Illinois," by Ellery B. Paine; "The Magnetic Properties of Some Iron Alloys Melted in Vacuo," by Trygve D. Yensen; "The Effect of Displaced Magnetic Pulsations on the Hysteresis Loss of Sheet Steel," by L. W. Chubb and T. Spooner; "The Unsymmetrical Hysteresis Loop," by J. D. Ball, and "Decomposing Magnetic Fields Into Their Higher Harmonics," by H. Weichsel. An enjoyable entertainment program for delegates has been arranged by the Jovian League and the Engineers' Club of St. Louis.

Public Service Commission News

Idaho Commission

In its decision in regard to the application of the Idaho Traction Company for increased passenger rates the commission stated that although it was compelled at the time to take the book value of the company's physical property as a basis in determining the reasonableness of the proposed rates, it is not a satisfactory basis for rate-making. Lack of funds necessary to make a physical valuation made the book valuation the only available one at the time the commission passed upon the question.

Washington Commission

The Puget Sound Traction, Light & Power Company of Seattle has offered to appropriate to the Public Service Commission an amount not to exceed $10,000 for the completion by the commission of its valuation of the traction company's properties at an early date. This offer is made by the company in order that the controversy between the traction company and the city of Seattle on certain franchise obligations may be terminated soon by a hearing before the commission. The Puget Sound Traction, Light & Power Company not only owns and operates electric lightning and power lines in Seattle and its environs but also operates all the street-railway lines, with the exception of two small municipal lines.

Indiana Commission

The commission has approved a new schedule of rates for the customers of the Roachdale Electric Light & Power Company. The schedule produces increases and decreases as follows: Business-room and office rate, an increase of 1 cent per kilowatt-hour for the first 40 kw.-hr. if bills are not paid on or before the tenth day of the succeeding month; residence rate, an increase of 1 cent per kw.-hr. for the first 25 kw.-hr. if bills are not paid on or before the tenth day of the succeeding month. Under the business contracts on energy consumptions of from 40 kw.-hr. to 50 kw.-hr., and under the residence contracts on energy consumptions of from 25 kw.-hr. to 30 kw.-hr., the rate is reduced 2 cents per kilowatt-hour.

Oregon Commission

An order abolishing an advance of $5 required by the Pacific Telephone & Telegraph Company for its flat-rate service, and also the cancellation fee, and reducing the advance deposit for metered service from $5 to $2.50 for residences, was issued recently by the Oregon Public Service Commission. The order becomes effective Nov. 1, and is the result of a general investigation commenced by the commission upon its own motion. The order also modified the company's regulations as to advance payment, termination of contracts and short-term contracts. Under the order subscribers may obtain a flat-rate service by the payment in advance for a period not to exceed that for which bills are regularly rendered, as specified in the utilities rate schedule. The utility may discontinue the flat-rate service for failure to pay in the manner prescribed, or on account of telephone charges being due from a customer because of the installation of such service, as covered by its lawful schedules. Service, however, cannot be discontinued until written notice has been given to the customer of intention to do so. A subscriber making application for metered exchange service may, in the absence of pre-payment collection devices, establish credit as follows: first, where he owns the premises to be served; second, where he makes a cash deposit; third, where he furnishes a guarantor for the payment of his bill; fourth, where he has paid all his bills to the telephone utility promptly during the twelve months prior to the effective date of the order. Provided that applicants for metered service make a cash deposit to insure payment, the amount shall not exceed $2.50 for residence service and not more than $5 for business service. Within thirty days after the order becomes effective, the company shall refund to customers deposits heretofore made to guarantee payment for telephone service where such deposits have been abolished, provided that the balance due the utility, including one month's rental, be paid.

Wisconsin Commission

In an application for an increase in rates, the Bloomer Electric Light & Power Company stated that an increase in revenue was necessary to provide for the construction of transmission lines if additional rural consumers were to be given service. After an investigation of the circumstances involved, the commission ordered the petitioner to furnish the transformer and lightning-arrester or other safety appliance necessary to provide energy for any rural consumer who will construct a service line of adequate rating to the transmission line of the Bloomer Electric Light & Power Company, and to furnish service at the rates now effective in Bloomer with the exception that the minimum bill may be increased to $2.50 per month.

The Beloit Water, Gas & Electric Company has been ordered to extend its service to two school buildings in Beloit provided the city guarantees the company an annual gross revenue sufficient to warrant the expenditure necessitated by additional line construction until such time as the connection of other consumers in the vicinity increases the amount of service rendered by the proposed extension so that the annual revenue derived therefrom at the prevailing rates shall be equal to the payments now to be guaranteed by the city.

New York Commission

The New York Edison Company, the United Electric Light & Power Company, the Yonkers Electric Light & Power Company and the Westchester Lighting Company have applied to the Public Service Commission, Second District, for the approval of franchises and contracts from and with the Board of Estimate of the city of New York whereby the companies are to be permitted to erect an electrical transmission line along the line of the Catskill Aqueduct in Westchester County. In return for the privilege of erecting this line on the aqueduct property the companies agree to furnish to the city free all of the electricity which it may need for the purposes of various machines necessary to the operation of the aqueduct. This free service, it is estimated, will be worth about $75,000 a year. Energy will be furnished the new line at the New York City line from the stations of the Edison and United companies. The Yonkers company will build in the city of Yonkers and the Westchester company through the rest of the county. The petition states that the franchises were applied for at the request of the New York City Board of Water Supply.

The Public Service Commission, Second District, has permitted the Lockport Light, Heat & Power Company to increase its rates on its showing that it was not earning a fair return on capital employed in the public service. An agreement was reached between the city and the company's representatives during the hearings that the actual fixed capital of the company employed in the electric business was $467,435.66, not including working capital and certain intangible items which the company claimed should be charged against reproduction cost. The return on this valuation was but a little over 2 per cent on the investment. Assuming a return of 7 per cent upon a valuation of $492,000, which includes $25,000 for working capital, income available for interest and dividends should be $34,435 per annum. The company must also earn an additional amount to take care of the increased cost of power. A schedule has been worked out which will enable the company to earn an increased revenue of $41,067 per annum if it is able to retain all its present customers. The rates go into effect as of Nov. 1, 1915, and are to continue for a period of three years thereafter unless sooner changed or modified by order of the commission.

The Public Service Commission, Second District, has dismissed the complaint of residents of Eden against the Eden Gas & Fuel Company as to poor service, refusal to accept new customers, and excessive price charged. At the hearings it developed that the service had improved since this complaint was filed and that the only question was that of price. Inspection by the commission's engineers revealed that the company was operating its business economically, that it paid no salaries to its officers and no dividends, and that it was burdened by a loan of $10,000 advanced by the stockholders. No evidence was brought to prove that the price of 50 cents per 1000 cu. ft. was illegal or unreasonable.

and it was shown that the company's supply of gas was being rapidly exhausted, justifying its refusal to take on new customers.

The so-called "jitney bus" law has been sustained in all its principal phases under an order of State Supreme Court Justice Hasbrouck, filed in the Albany County Clerk's office on Sept. 27. An announcement in the matter made by the New York Public Service Commission in the Second District says:

"Justice Brown of the Supreme Court in Niagara County has decided, in the case of Public Service Commission, Second District, versus Burt G. Hurtgam, that all of the following classes of vehicles come within the scope of this statute and must secure consents from the local authorities and certificates of public convenience and necessity from this commission for operation wholly or partly within any city of the State: (a) a bus line; (b) a stage route; (c) a motor-vehicle line or route; (d) a vehicle in connection with a bus line, a stage route, a motor-vehicle line or route; (e) a vehicle carrying passengers at a rate of fare of 15 cents or less for each passenger within the limits of a city; (f) a vehicle carrying passengers in competition with another common carrier which is required by law to obtain the consent of the local authorities of said city to operate over the streets thereof."

Corporate and Financial

Bronx Gas & Electric Company, New York, N. Y.—The Public Service Commission of the First District of New York has authorized the company to replace in its treasury $16,880 previously expended upon the improvement of its plant. This amount is to be withdrawn from the proceeds of the sale of $200,000 in bonds previously authorized by the commission. As the company prior to 1909, when the uniform system of accounts prescribed by the commission went into effect, had not kept its books in sufficient detail to afford definite information as to the cost of the property, the commission has had an appraisal made which makes the reproduction cost less depreciation $998,860.53. This total includes an allowance of $160,243.71 for overhead charges and incidentals.

Brook (Ind.) Utilities Company.—The Indiana Public Service Commission has authorized the issuance of $15,000 of common stock and $15,000 of preferred stock.

Consolidated Gas, Electric Light & Power Company of Baltimore, Md.—At the annual meeting of the stockholders the following directors were elected to fill the existing vacancies on the board: Howard Bruce, vice-president and general manager of the Bartlett-Hayward Company; Siegmund B. Sonneborn of the firm of Henry Sonneborn & Company; Morton Otis of London, England, a member of the banking firm of Aldred & Company, and Frank M. Tait of New York.

Connecticut River Transmission Company, Worcester, Mass.—The results of the company's operations for the year ended June 30, 1915, have been filed with the Massachusetts commission and show a total output for the period of 125,351,717 kw.-hr. During the year the company, which operates the largest hydroelectric system in New England, sold 51,921,760 kw.-hr. for motor service, 28,348,216 kw.-hr. to street railways and 28,655,959, kw.-hr. to other companies, making a total sale of 108,925,325 kw.-hr. to commercial customers. In its own lighting and auxiliary service the company utilized a total of 375,947 kw.-hr., and the total energy unaccounted for was 16,049,835 kw.-hr. The company reports forty-five customers, including numerous central stations, municipal plants and industrial establishments. The total earnings for the year were $1,010,314. The principal items were electric energy (except for street railways), $507,733; energy for street railways, $169,302, and sales to other companies, $317,436. During the year the company purchased about 90,000,000 kw.-hr., including 75,566,087 kw.-hr. from the affiliated New England Power Company with hydroelectric plants in the Deerfield Valley; 6,059,569 kw.-hr. from the Metropolitan Water and Sewerage Board, operating a hydroelectric station at the Clinton (Mass.) dam; 4,989,800 kw.-hr. from the Berkshire Street Railway, mainly from the Zylonite steam turbine plant near the Hoosac Tunnel; 2,428,280 kw.-hr. from the Worcester (Mass.) Electric Light Company; 1,425,000 kw.-hr. from the Fitchburg (Mass.) Gas & Electric Light Company, and the rest from other plants. The return shows that the interchange of energy between the company and local central stations in its territory is a most advantageous arrangement, permitting the articulation of water-power and steam-generating facilities upon an attractive economic basis. The unit purchase price in general where substantial quantities of energy were involved varied from about 4 mills to 1 cent per kilowatt-hour, and the unit sale price to other companies as a rule ranged from 1.1 cents to 1.2 cents per kilowatt-hour. To the municipalities of Boylston, Holden, Sterling and West Boylston energy was sold at 2.5 cents per kilowatt-hour, the consumption ranging from 22,930 kw.-hr. to 83,826 kw.-hr. The city of Worcester purchased 103,200 kw.-hr. at a unit price of 1.51 cents. The transmission company's manufacturing expenses for the year totaled $196,097, purchased energy came to $526,361, and transmission and distribution expense was $216,021. The expenses of the sales department totaled $3,741, general office expenses $17,179, taxes $19,500, and miscellaneous $9,041, making total expenses $987,942. A dividend of 1 per cent was paid in May and June. The company operates the plants of the New England Power Company at Shelburne Falls and Monroe Bridge, Mass., and various other plants. Energy is delivered to it at the Massachusetts-New Hampshire State line by the Connecticut River Power Company of New Hampshire, whose principal station is near Vernon, Vt.

Denver (Col.) Gas & Electric Light Company.—The earnings for the twelve months ended Aug. 31, besides showing an increase of almost $50,000 in gross, showed a decrease of nearly $150,000 in operating expenses, maintenance and taxes, resulting in an increase in net earnings of slightly less than $200,000. The comparative statement for the twelve months ended Aug. 31, 1914 and 1915, follows:

	1915	1914
Gross earnings	$3,218,820	$3,169,789
Operating expenses, maintenance and taxes	1,616,776	1,765,597
Net earnings	$1,602,044	$1,404,192
Interest	380,515	380,515
Balance	$1,221,529	$1,023,677

Edison Electric Illuminating Company of Brockton, Mass.—A meeting has been called for Oct. 19 to increase the company's stock by an issue of 2110 shares at $140 a share. Stockholders may subscribe for the new stock at $140 a share in the ratio of one share of new stock for every six shares now held. Dividends, which were payable semi-annually, will now be paid quarterly. The proceeds from the sale of the new stock, amounting to $295,400, will be used to retire $225,000 of floating debt and for plant additions.

Hawks Electric Company, Goshen, Ind.—The Indiana Public Service Commission has granted authority to the company to issue $32,500 in bonds and $10,000 in stock to pay for the construction of a new unit in its plant at Goshen. The new unit is to cost approximately $40,000. The stock is to be sold at not less than par and the bonds may not be sold at less than 93.

Lacombe Electric Company, Denver, Col.—A block of $50,000 of first mortgage 5 per cent bonds due May 1, 1921, is being offered at 97 and interest to net 5½ per cent. The ownership of the company was acquired in 1911 by the Denver Gas & Electric Light Company.

Merchants' Heat & Light Company, Indianapolis, Ind.—The Indiana Public Service Commission has authorized the company to sell $68,000 of stock and $272,000 in bonds to reimburse its treasury for sums expended since March 31 of this year for betterments and improvements. The city of Indianapolis gave its approval of the issue. This issue makes a total well over $1,000,000 of securities issued by this company under the approval of the commission since the company won its fight to have the commission recognize its need for more money, after it had received the city lighting contract in Indianapolis.

Middleburg (N. Y.) and Schoharie Electric Light, Heat & Power Company.—The Public Service Commission of the Second District of New York has approved an issue of $20,000 of 6 per cent first refunding mortgage bonds at

par, under a thirty-thousand-dollar mortgage to the Albany Trust Company. The proceeds of the bonds are to be used to refund $9,000 outstanding first mortgage 5 per cent bonds and to reimburse the treasury for expenditures properly chargeable to capital account between 1911 and 1914.

Morgan County Light & Power Company, Martinsville, Ind.—The Indiana Public Service Commission has authorized the company to issue $2,020 in preferred stock for betterments to the plant at Morgantown.

Morocco (Ind.) Utilities Company.—The Indiana Public Service Commission has authorized the company to sell $8 000 of common stock and $15,000 of preferred stock.

Narragansett Electric Lighting Company, Providence, R. I.—The directors have voted to issue $500,000 of stock in fifty-dollar shares, to be allotted among holders of stock and debentures of the company of record Oct. 4, 1915, in the ratio of one new share at par for every fourteen shares of old stock or debentures held.

Pacific Light & Power Corporation, Los Angeles, Cal.—The California Railroad Commission has issued an order authorizing the Newport Land Company to sell to the Pacific Light & Power Corporation its electrical distributing system on Balboa Island in Orange County. The light and power corporation was further given the right to purchase from the Sierra Power Company the plant, land and water rights in San Antonio Creek.

Quebec (Canada) Railway, Light, Heat & Power Company, Ltd.—The annual report of the company for the year ended June 30, 1915, shows the following earnings.

Gross earnings from operation	$1,548,096
Miscellaneous income	235,978
Total revenue from all sources	$1,784,074
Operating and maintenance expenses	924,817
Net earnings	$859,257
Fixed charges and taxes	739,482
Net surplus	$119,775
Previous surplus	227,724
Total surplus as of June 30, 1915	$347,499

San Joaquin Light & Power Corporation, Fresno, Cal.—The California Railroad Commission has authorized the company to renew $91,481.12 of promissory notes for not more than one year from Dec. 31, 1915, with interest at from 6 to 7 per cent. The notes are to engineering and machinery concerns and to banks. The money was expended for plant.

Santa Barbara (Cal.) Gas & Electric Company.—The California Railroad Commission has issued a supplemental order authorizing the company to issue $15,000 of first mortgage 6 per cent thirty-year gold bonds, to defray cost of betterments to the company's plant.

Southern Sierras Power Company, Denver, Col.—The California Railroad Commission has authorized the company to issue $948,000 of bonds. Of this amount $798,000 are to be used for paying the company's indebtedness to its affiliated corporations and the balance for the payment of notes and additions to its properties.

Trinidad Electric Company, Ltd., Port of Spain, Trinidad.—Notice has been sent to stockholders that the October dividend will not be paid. The company has paid a dividend of 5 per cent for ten years or more on the stock. The reason assigned is the increasing cost of fuel and the proposal to install an equipment for using oil as fuel. The paid-up capital stock of the company is $1,164,000.

Western States Gas & Electric Company, Stockton, Cal.—The California Railroad Commission has issued a supplemental order authorizing the company to use the proceeds from the sale of $74,000 of bonds for plant betterments, and of $10,000 bonds to reimburse the company for similar expenditures made during May, 1915. The remaining $182,000 of an authorized issue of $266,000 is authorized to be delivered to the company upon deposit with its trustee of the face value of such bonds in cash, such deposits to be withdrawn for expenditures for plant approved by the commission.

Wooster (Ohio) Electric Company.—The Ohio Public Utilities Commission has authorized the company to issue $70,000 of common stock and $50,000 of 6 per cent preferred stock, $30,000 of which is to be sold at not less than par and the remainder at not less than 95. The common stock is to be sold at not less than 85. The proceeds from the sale of these securities are to be used for the discharge of $30,000 of outstanding 6 per cent bonds, for the construction of a transmission line to the amount of $20,000, for the discharge of a ten-thousand-dollar note, and for the reimbursement of the treasury to the amount of $48,138 for money expended for the purchase of real estate and for certain construction work.

United States Public Service Company, St. Louis, Mo.—The consolidated earnings of the subsidiary companies show large increases for the twelve months ended Aug. 31, in comparison with the previous year. The increase in gross earnings was over $80,000, while the expenses increased but $12,000. The net earnings therefore show a gain of $68,000, which in itself is equal to almost one-half the interest requirements of the company. The comparative consolidated earnings statement of the subsidiary companies for the year ended Aug. 31, 1914 and 1915, follows:

	1915	1914
Gross earnings	$885,700	$805,446
Operating expenses and taxes	518,404	506,187
Net earnings	$367,296	$299,259
Interest requirements	152,239	136,199
Balance	$215,057	$163,060

Manufacturing and Industrial

Cohen's Hardware & Electric Supply Company, Providence, R. I., has discontinued its business.

W. M. White has resigned as sales manager of the Esterline Company of Indianapolis, Ind., manufacturer of headlamps.

The Westinghouse Lamp Company, 1261 Broadway, New York, has moved its Philadelphia office from the North American Building to the Widener Building.

The Page & Hill Company, Minneapolis, Minn., dealer in cedar poles, has opened an office at 19 South LaSalle Street, Chicago, Ill., under the management of E. C. Stockdale. Mr. Stockdale was formerly connected with the Stone & Webster Engineering Corporation.

Electric Range Company to Expand.—The Globe Stove & Range Company of Kokomo, Ind., has decided to open branch offices in one city in the East and in another city on the Pacific Coast. The company now has an office in the new Edison Building in Chicago and is maintaining an extensive electric range display in the Commonwealth Edison Company's Electric Shop.

Brown Instrument Company Increases Size of Plant.—On account of its growing business, the Brown Instrument Company, Philadelphia, Pa., manufacturer of pyrometers and other instruments, has decided to enlarge the new factory into which it moved about a year ago. An addition will be built which will provide nearly 50 per cent additional floor space. During the past year the company has noted a specially large demand for its pyrometers for control of high temperatures.

Electric Locomotive Exhibited en Route to the Exposition.—One of the new electric locomotives recently purchased from the General Electric Company by the Chicago, Milwaukee & St. Paul Railway Company was exhibited last week at Chicago, St. Paul, Minneapolis, Spokane, Seattle and Tacoma. At each point the time and place at which the locomotive was to be on exhibition were announced in advance in the local newspapers. The locomotive was in charge of two men who answered questions asked by the public. Motion pictures of the engine in operation are to be taken and will be exhibited at points along the lines of the St. Paul Railway.

Cooper Hewitt Company Working Plant at Night.—The Cooper Hewitt Electric Company, Hoboken, N. J., has noted a large increase in its business the past year and is now working its plant until 10 o'clock five nights a week. Orders in large numbers are being received for its mercury-vapor lamps for motion-picture-studio and industrial lighting. The lamps are especially well adapted for the illumination of foundries, machine and erecting shops, textile

mills, automobile-finishing departments, printing establishments, etc.

The Prince Electrical Equipment Company, 116 North Independent Street, Enid, Okla., which has recently been formed, is in the electrical supply and jobbing business and also expects to take up the manufacture of electrical devices. The company has organized a department for selling and repairing automobile-starting devices, and will also be engaged in inside electrical construction and wiring, repairing and rebuilding of electrical machinery, armature winding, and maintaining storage-battery stations. C. C. Wilcox is president of the company, J. S. Trimble vice-president and treasurer, and C. C. McVay secretary and manager.

Increasing Demand for Electrical Supplies in Southeastern Cuba.—According to Consul P. Merrill Griffith, there is a constantly increasing demand for electrical supplies and apparatus in Santiago de Cuba and throughout his district. Especially is this true in the interior of the district, where many improvements are being made on sugar plantations and new mills are being erected. There is a steady call, the consul states, for ordinary electrical supplies such as are in general use, and an excellent opportunity presents itself to create a demand for various kinds which are popular and of more recent development. In recent years most of the electrical goods in Cuba have been obtained from the United States.

Robbins & Myers Company Builds Garage for Employees.—In line with the tendency in modern manufacturing establishments to provide every convenience and comfort for its employees, the Robbins & Myers Company, Springfield, Ohio, has just completed a garage to house the machines of its workmen. The building is of brick and steel construction, the brick being stuccoed. Daylight illumination is obtained both from windows in the side walls and from skylights. Night illumination is provided by tungsten lamps of high ratings with metal reflectors. The building is 84 ft. by 64 ft. and will house between thirty and forty cars around the walls without using any of the space at the center of the floor, enabling every car to run in or out without moving any other car. The floor is marked off, and to each employee who drives a car has been assigned a position which belongs to him permanently, thus avoiding any confusion among the drivers as they enter the garage.

Employees of Westinghouse Company Vote Not to Strike.—The employees of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., last week voted not to strike. The ballot which was taken follows: For strike, 2495; against strike, 7073; void ballots, 83; total, 9651. John L. Lewis, organizer for the American Federation of Labor, announced that he would continue to organize the employees of the Westinghouse Electric & Manufacturing Company, regardless of the outcome of the ballot. The trouble between the officials of the company and the employees was over the length of working hours and the wages. The employees demanded an eight-hour schedule and a 10 per cent increase of wages. The company offered a compromise of eight hours and forty minutes—fifty-two hours a week—and an adjustment of wages to give the same weekly wage for fifty-two hours that was obtained for fifty-four hours' work. In addition to this the company offered to grant a bonus to all shop employees of 6 per cent on the earned wages, payable in progressive quarterly installments.

Lucien Barnes, in charge of the export sales department of the Westinghouse Lamp Company at 165 Broadway, intends to take an extensive trip through South America to investigate conditions as they affect the electrical industry in general and particularly the lamp business. He will travel about 17,600 miles and will visit the following cities: Rio Janeiro and Sao Paulo, Brazil; Buenos Aires, Argentina; Montevideo, Uruguay; Valparaiso and Iquique, Chile; La Paz, Bolivia; Lima and Callao, Peru; Guayaquil, Eucador; Panama City, Panama; San José, Costa Rica; Santa Ana and Sosonate, Salvador; Guatemala City, Guatemala; Puerto Colombia, Barranquilla and Bogota, Colombia; Caracas, Venezuela; Kingston, Jamaica; Santiago and Havana, Cuba. Mr. Barnes has been in charge of the export department of the Westinghouse company since February, 1914. Prior to that time he was connected with an electrical concern in Havana, Cuba, and he has also been connected with the export department of the Westinghouse Electric & Manufacturing Company for eight years. During his absence Irving B. Cary will have charge of the export sales department of the Westinghouse Lamp Company.

Many Uses for Adjustable Lighting Fixtures.—According to R. D. H. Anderson of the Frank Ridlon Company, Boston, Mass., new uses are continually being found for his company's adjustable lamp holders. One of these holders was described in the ELECTRICAL WORLD of Nov. 14, 1914, page 972. All of the fixtures are provided with friction disks so placed that they serve as universal joints. The principle is also being adapted to photographic-lamp stands, making it possible for the operator to adjust the lamp to any angle or position desired. Mr. Anderson states that there is quite a demand for the stands. The stands can also be utilized for lighting in dental parlors and opticians' offices. Other fixtures equipped with the friction disks are designed for use with sewing machines, enabling lamps of small ratings to be employed, Mr. Anderson declares, and increasing the efficiency of the operators. The fixtures are also convenient for bench and office lighting, and illumination in banks, drafting rooms, libraries, laboratories, etc. The Frank Ridlon Company is also making a portable vacuum cleaner, and with each machine sold a General Electric iron is given. As a result of this method of disposing the cleaner, large orders have been recently received, Mr. Anderson declares, and the company is very busy turning out the product.

Developments in Gas-Filled Lamps.—Henry Schroeder of the General Electric Company, Harrison, N. J., recently stated that up to the end of July about 1,500,000 gas-filled lamps had been sold by his company in this country, and it is estimated that with this product central-station companies have within a year increased their income by over $25,000,000. Owing to a ruling of the Underwriters' Laboratories, Inc., the 300-watt gas-filled lamp, formerly fitted with a medium screw base, is now standard with a Mogul screw base. With the making of this change the light-center length was slightly increased, so that the lamp can now be used with fixtures and reflectors designed for 400-watt and 500-watt lamps. Gas-filled lamps are now available in sizes with ratings of from 200 watts to 1000 watts in a voltage range of 220 volts to 250 volts and are made in the same bulbs as the 105-volt to 125-volt lamps. The efficiency of the 15-amp. and 20-amp. lamps for series street lighting has recently been increased, the specific consumption of the 1000-cp. lamp now being claimed as 0.45 watt per candle-power. Although the light is said to be satisfactory, series gas-filled lamps are not at present recommended for direct or rectified-current series circuits, as the filament in breaking forms an arc which is liable to work up into the base and burn up the socket.

Cincinnati Electrical Show Company Incorporated.—As a necessary preliminary to the holding of an electrical show in Music Hall, Cincinnati, Ohio, during Electrical Prosperity Week, Nov. 29 to Dec. 4, the Cincinnati Electrical Show Company has been incorporated with a capital stock of $25,000. The incorporators are Messrs. W. W. Freeman, J. A. Brett, T. J. Ryan, W. G. Reuter and L. T. Milnor. For this year's show it is proposed to divide the first floor of the Music Hall north hall into approximately 150 exhibition spaces or booths, 10 ft. by 10 ft. in size, which are to be sold to exhibitors at $100 per space or $1 per square foot floor space, such charge to include standard decorations as well as general illumination and use of electric energy for individual exhibits, with reasonable restrictions. It is proposed to use the second floor of the hall for exhibitions of electric automobiles, with a running track for demonstration purposes, and to charge a somewhat less sum for exhibition space than on the first floor. The company is already assured of the active participation of the larger electrical interests in the city, including the Union Gas & Electric Company, the Cincinnati Traction Company, the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Western Electric Company, the Union Light, Heat & Power Company and others. These interests plan to take approximately 25 per cent of the available space in the show.

Splitdorf Company Buys Dixie Magneto Patents.—The Splitdorf Electrical Company, Newark, N. J., recently purchased the Sumter Electrical Company of Sumter, S. C., which controlled the basic patents of the Dixie magneto invented by Charles T. Mason. One million dollars was the purchase price. The Splitdorf company will continue to manufacture magnetos at Sumter for stationary-engine, marine-engine and tractor service. Magnetos for automobiles, motorcycles and aeroplanes, however, will be made exclusively at its plant in Newark. The Splitdorf Electrical Company is now building 1500 Dixie magnetos daily for single-cylinder, two-cylinder, four-cylinder, six-cylinder, eight-cylinder and twelve-cylinder engines.

NEW YORK METAL MARKET PRICES

	Oct. 5 Selling Prices Bid	Oct. 5 Selling Prices Asked	Oct. 11 Selling Prices Bid	Oct. 11 Selling Prices Asked
	£ s d	£ s d	£ s d	£ s d
London, standard spot*	72 2 6		.. .. ..	
Prime Lake	17.87½ to 18.12½		17.87½ to 18.12½	
Electrolytic	17.87½ to 18.12½		17.87½ to 18.12½	
Casting	17.25 to 17.50		17.25 to 17.50	
Copper wire base	19.25 to 19.50†		19.25 to 19.50†	
Lead	4.50		4.50	
Sheet zinc, f.o.b. smelter	16.00†		16.00†	
Tin, Straits	32.12½†		32.75†	
Aluminum, 98 to 99 per cent.	50.00 to 51.00		55.00 to 57.00	

*OLD METALS

Heavy copper and wire	16.25	15.25†
Brass, heavy	11.00	10.25†
Brass, light	9.25	8.50†
Lead, heavy	4.20	4.00†
Zinc, scrap	10.75	10.00†

*COPPER EXPORTS

Total tons to Oct. 11	6,955

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The People's Power & Light Company of Botkins, Ohio, has been incorporated with a capital stock of $15,000 by J. W. Sheets, A. A. Sheets, G. Bush, I. H. Sheets and G. E. Bush.

The Edmore Light & Power Company of Edmore, N. D., has been granted a charter with a capital stock of $10,000. The incorporators are H. J. Nyhus, M. M. Van Osdel and Charles C. Honey.

The City Electric Company of Albuquerque, N. M., has been incorporated with a capital stock of $250,000 by George Reslington, Lloyd E. Sturges and E. L. Gross, all of Albuquerque. The company intends to operate a railroad system and trackless vehicles and also to do a general electrical-power business.

New Industrial Companies

The Dahlgren Electric Light Company of Dahlgren, Ill., has been incorporated by L. L. Aydt, William Acks and F. F. Aydt. The company is capitalized at $25,000 and purposes to generate and distribute electricity for lamps and motors.

The Talking Electric Fan Company of Minneapolis, Minn., has been incorporated with a capital stock of $80,000 by Elmer S. Leach, E. Lynn Leach, A. M. Ellert and William B. Krause, Minneapolis, and J. H. S. Gifford, St. Paul, Minn.

The Rochelle Electric Manufacturing Company of Rochelle, Ill., has been incorporated by W. R. Dusher, Frank Carney and J. C. Fesler. The company is capitalized at $35,000 and purposes to manufacture and deal in electric motors, dynamos and electrical appliances.

The Gardner-Stedman Company of Chicago, Ill., has been chartered with a capital stock of $1,000 for the purpose of manufacturing and dealing in electrical devices and also to do electric wiring and construction work. The incorporators are Fulton Gardner, Seymour Stedman and Swan M. Johnson.

Trade Publications

Disconnecting Switch.—The Minerallac Electric Company, Chicago, Ill., has published Bulletin No. 70, on its balanced disconnecting switch.

Wiring Devices.—Pass & Seymour, Inc., Solvay, N. Y., are sending out leaflets which give some changes recently made in Catalog No. 23.

Small Electric Hand Lantern.—The "Boy Scout" electric hand lantern is described and illustrated in a leaflet issued by the Lincoln Electric Works, Chicago, Ill.

Electric Water Heater.—The International Electric Company, Indianapolis, Ind., has published an illustrated folder on its electric water heater for bar and soda-fountain service.

Pole Jacks.—Templeton, Kenly & Company, 1020 South Central Avenue, Chicago, Ill., have prepared illustrated Catalog No. 115, containing information on a jack for raising transmission-line and telegraph poles.

Tree Insulator.—A folder which contains information and illustrations on an insulator for protecting shade trees from city transmission lines is being sent out by the Frank Ridlon Company, 158 Summer Street, Boston, Mass.

Electric Supply Catalog.—The Alpha Electric Company, 116 West Twenty-ninth Street, New York, has just issued an illustrated 238-page pocket edition of Catalog No. 10, which contains an extensive list of standard electrical material.

Silver-Plated Electric-Cooking Appliances. — Landers, Frary & Clark, New Britain, Conn., have prepared an illustrated folder which shows various types of electric cooking appliances of American-Sheffield plate backed on solid white-nickel silver.

Home Lighting.—The Westinghouse Lamp Company, 1261 Broadway, New York, has just published an attractive booklet entitled "Lighting That Makes the Home Attractive." The booklet contains a large number of illustrations of actual lighting installations, showing the proper ways of lighting in the home.

Ball Bearings.—Bulletin No. 49 issued by the S K F Ball Bearing Company, 50 Church Street, treats of and is entitled "Self-Aligning Ball-Bearing Hangers," and Bulletin No. 45 issued by the same company, entitled "Ball Bearings for Car-Lighting Generators," shows the application of ball bearings to that service.

Switches.—List No. 1 just issued by Messrs. A. P. Lundberg & Sons, 477 Liverpool Road, London N., England, is a handsome quarto volume of nearly ninety pages and deals with four of the company's types of Tumbler and other small switches. These are the single way, "Twinob," double-pole and triple-pole switches.

The Wagner Electric Manufacturing Company, 6400 Plymouth Avenue, St. Louis, Mo., is sending out miniature booklets of its bulletins No. 109, No. 110, No. 111 and No. 112. The booklets are entitled "Single-Phase Motors," "Single-Phase Converters for Motion-Picture Projection," "Polyphase Motors" and "Generators and Synchronous Motors."

Electric Apparatus.—The Western Electric Company, New York, has issued folders and booklets on telephones for farm use, "Ever-ready" fountain-pen flashlamps, "Matthews Scrulix" anchors, sewing-machine motors, shaving lamps, Hartford automatic time switches, "Recti" electric bells, "Flextube," No. 1 type convertible switchboard, Crouse-Hinds multi-meter panelboard, "G-L" time-switch clocks, Fort Wayne water-supply systems, stationary vacuum cleaners, Hughes electric ranges and vibrators.

Waterwheel Generators and Electric Railway Equipment.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has just issued an attractively illustrated thirty-one-page catalog, designated as Circular No. 1536, on "Alternating-Current Waterwheel Generators." It has also just published Special Publication No. 1562, on "Railway Equipments and Locomotives in the Far West." Another interesting circular issued by the company is Special Publication No. 1561, which contains information on the Westinghouse company's exhibit at the Panama-Pacific Exposition.

Construction News

New England

BERLIN, N. H.—The Berlin Mills Co. is making improvements to the water-power on the site formerly occupied by the Forest Fibre Co. It is proposed to utilize the water-power to generate electricity for use in the mills.

HORTONVILLE, VT. — Arrangements are being made by the Hortonia Pwr. Co., Hortonville, to extend its transmission lines from Hortonville to Orwell, a distance of 5½ miles. Another extension is also to be made from Sudbury to Hyde Manor. I. M. Frost, Rutland, is vice-president and general manager.

BROCKTON, MASS.—A special meeting has been called by the Edison El. Illg. Co. of Brockton for Oct. 19 to vote on the proposal to increase its capital stock by 2110 shares at $140 per share. Proceeds of the new stock amounting to $295,400 will be used to retire $225,000 floating debt and the remainder for plant additions.

MILFORD, MASS — The Connecticut River Transmission Co., Worcester, has begun work on the erection of a high-tension transmission line from Rice City to Milford, a distance of 8½ miles. The work will be done by the C. H. Kendall Construction Co., Boston, and will cost about $14,000. Energy will be delivered at 14,000 volts and will be used as an auxiliary service by the Milford El. Lt. & Pwr. Co.

SOUTHWICK, MASS.—The Southwick El. Lt. Co., after investigating several proposals to purchase energy, has decided to build a power plant in Southwick. The company will install a 100-hp. engine, and this, together with the water-power, which will average 75 hp. except during the dry season, will be used to operate the proposed plant. The company purposes to increase its capital stock to $15,000 and will begin work on erection of distribution system as soon as permission is granted by the town.

WALLINGFORD, CONN.—The electric light commissioners are planning to erect ornamental lamps on Center Street.

Middle Atlantic

ALBANY, N. Y.—Bids will be received at the office of Hoppin & Koen, architects, 244 Fifth Avenue, New York, N. Y., until Nov. 8, for furnishing and installing the lighting fixtures and furnishing the incandescent electric lamps for the Albany County court house. For details see proposal columns.

DELEVAN, N. Y.—The village of Delevan has voted to install an electric-lighting system. The village will installl its own distribution system and will purchase electricity from the Arcade municipal plant.

EAST AURORA, N. Y.—The proposal to install a new street-lighting system will soon be submitted to the taxpayers. It is proposed to replace the present system, consisting of 35 lamps of 60 cp., with 52 lamps of 250 cp. The cost is estimated at about $6,000.

HILTON, N. Y.—The Hilton El. Lt., Pwr. & Ht. Co. has applied to the Public Service Commission for permission to extend its transmission lines to the town of Parma and for approval of a franchise granted by the town.

LAKE PLACID, N. Y.—At a special election held recently the Board of Village Trustees was authorized to enter into a five-year contract with the Paul Smith's, Lt., Ht., Pwr. & R. R. Co., Paul Smith's, for electricity as required over the amount the municipal plant can produce. A transmission line will be erected by the company to the eastern boundary of the village, and the village will build a line to connect with it. The cost of making the proposed change is estimated at $10,000.

NEW YORK, N. Y.—A movement has been started by the Bronx Board of Trade to obtain modern power buildings and an industrial belt line. One power building, it is stated, is already assured for the south Bronx, while another is projected.

SALAMANCA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 12 for construction, including mechanical equipment and approaches, of the United States post office at Salamanca. Drawings and specifications may be obtained from the custodian of site at Salamanca or at the above office.

WARSAW, N. Y.—The Public Service Commission has authorized the Warsaw Gas & El. Co. to exercise a franchise recently granted it in Gainesville and Warsaw to supply electricity.

EAST PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 6 for the construction, including mechanical equipment and approaches, of the United States post office at East Pittsburgh. Drawings and specifications may be obtained at the above office or from the custodian of site at East Pittsburgh.

PHILADELPHIA, PA.—The contract for the construction of a power house for the Children's Hospital, at Eighteenth and Bainbridge Streets, has been awarded to the Roydhouse-Arey Co., Philadelphia, at $2,200. Bids for equipment will be asked for later.

WICONISCO, PA.—The Sterling Consol. El. Lt., Ht. & Pwr. Co., Tower City, which operates the local electric-light system, has, it is reported, sold the plant to a party of Baltimore and Philadelphia capitalists. The new company will be known as the Lykens Valley Lt. & Pwr. Co.

HOBOKEN, N. J.—The City Commissioners have approved the specifications for the new street-lighting system and have directed the city clerk to advertise for bids. The specifications provide for the installation of ornamental lamps, maintained by underground wires, in the business district; also for lighting the streets, parks and other public places, lamps of 400 cp. and 600 cp. to be used.

JERSEY CITY, N. J.—A movement has been started by the Ocean Avenue merchants to secure an ornamental street-lighting system on that thoroughfare.

PERTH AMBOY, N. J.—The installation of an ornamental street-lighting system on the lower portion of Water Street is under consideration by the Board of Aldermen.

TRENTON, N. J.—The Ajax-Grieb Rubber Co., Trenton, it is reported, is planning to erect a new building, 200 ft. by 350 ft., for its plant. The improvements include a new power house, engine, generators and boilers. Horace De Lisser is chairman board of directors.

WILMINGTON, DEL.—The Street and Sewer Department has granted the Wilmington Lt. & Pwr. Co. permission to construct a conduit system on Third Street from Orange to King Street for the purpose of putting its wires underground.

WILMINGTON, DEL.—Passenger trains on the Chestertown and Centerville branches of the Delaware division of the Pennsylvania Railroad, extending south from Townsend, will be operated by electricity. The storage-battery system or gas-electric cars will be used.

BALTIMORE, MD.—Henry Hess, formerly of the Hess-Bright Mfg. Co., Philadelphia, Pa., and several Baltimore capitalists, it is reported, will establish a million-dollar plant in Baltimore for the production of high-grade steel products to be manufactured by the electrical process. The Baltimore Trust Co., the United States Fidelity & Guaranty Co. and the Consol. Gas, El. Lt. & Pwr. Co. are said to be interested.

CHESTERTOWN, MD.—The Chestertown El. Lt. & Pwr. Co. has applied to the Public Service Commission for permission to issue $20,000 in bonds, of which the proceeds of $15,000 is for refunding purposes and the remainder for the purchase and installation of additional machinery.

CHARLESTON, W. VA.—Arrangements, it is reported, have been made by the Virginia Pwr. Co., Charleston, to supply this city with electricity generated at the plant at Cabin Creek Junction, connection to be made by Jan. 1.

HINTON, W. VA.—The Virginia-Western Pwr. Co., Clifton Forge, Va., it is reported, is contemplating the erection of an auxiliary steam-driven electric plant near Hinton, to furnish electricity to various towns in this vicinity.

ROANOKE, VA.—The Norfolk & Western R. R. Co., it is reported, is planning to equip the Simmons and the Pocahontas branch lines for electrical operation within the next six months.

WASHINGTON, D. C.—Bids will be received by the United Sttes Department of Agriculture, Washington, D. C., until Oct. 22 for furnishing and installing laboratory hoods, fans, motors, ventilating system, etc., in the food-inspection laboratory, United State appraiser's stores, New York, N. Y. Complete specifications may be obtained from the office of the chief clerk of this department.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 2 for furnishing at navy yards and naval stations supplies as follows: Norfolk, Va., Schedule 8895—5000 lb. ammonium battery chloride. Philadelphia, Pa., Schedule 8882—six electric hoists. Brooklyn, N. Y., Schedule 8894—3500 ft. single-conductor wire. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 18,463—A commercial attaché informs the bureau that a miller in Chile desires to purchase electric ovens capable of baking from 3000 lb. to 5000 lb. of flour per day. It is requested that operating charges be stated in responding to this opportunity. Correspondence may be either in Spanish or English. No. 18,625—An American consul in the United Kingdom reports a good market for arc-lamp carbons, ash oars, beveled glass, chemical supplies, etc. No. 18,634—An American consular officer in France reports that an agent desires to enter into commercial relations with manufacturers of electric elevators and supplies and to obtain

The First Tall Building in Evansville, Ind., Will Contain a 150-Kw. Power Plant with Mechanically Fired Boilers

The first tall building to be erected in Evansville, Ind., is shown in the accompanying illustration and is scheduled for completion during the latter part of November. It is a ten-story bank and office structure faced with terra cotta and is being built for the Citizens' National Bank of Evansville. The building was designed by W. L. Stoddard, architect, 9 East Fortieth Street, New York City, with George M. Hopkinson as structural engineer. The first and mezzanine floors will be occupied by the bank, and the upper floors will be divided into offices.

The G. A. Fuller Company of Cleveland, Ohio, has charge of the work as contractor. Otto E. Goldschmidt, consulting engineer, 9 East Fortieth Street, New York City, has been responsible for the electrical, steam-heating and power-plant layout. The specifications for the latter are interesting since they call for mechanical stokers and for an especially economical operating layout for a station of 150-kw. rating. The power plant will be installed in the basement and will contain two Sprague direct-current generators—one of 100 kw. rating and another of 50 kw., each to be driven by a Skinner high-speed engine. Brownell boilers will be used, equipped with Detroit underfeed stokers. The power-plant equipment will be installed by Gottman & Weber of Evansville, Ind. The contract for the electrical work throughout the building has been secured by the Sanborn Electric Company of Indianapolis, Ind. Besides being capable of handling the lighting load of the building the rating of the generating equipment is sufficient to operate three electric elevators. The two passenger elevators were made by the Otis Elevator Company, New York City, and the one electric freight elevator was built by the Grote Manufacturing Company of Evansville, Ind.

as soon as possible catalogs and price lists. Correspondence may be in English. No. 18,652—An American consular officer in Italy reports that a doctor in his district desires to receive catalogs and prices of X-ray machines. Prices, if possible, should be given c.i.f. Palermo. Correspondence should be in Italian. No. 18,662—A report from an American consular officer in India states that a company desires to receive full information in regard to machinery for an ice plant, an aerated water factory and a mill for extracting oil from copra and simsim (sesame). All the machinery to be driven by electricity generated by means of oil engines, which are also to be purchased. Detailed correspondence is solicited and not catalogs. Further information may be obtained upon application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches.

North Central

PETOSKEY, MICH.—Efforts are being made by the City Council to secure water-power sites on the lower Bear River for the erection of a power plant to be operated in connection with the two plants owned by the city to supply energy for commercial purposes.

SAGINAW, MICH.—The City Council has awarded the contract for ornamental street-lighting in the business district to the Consumers' Pwr. Co. for a period of ten years. The contracts call for the installation of 100 lamps, the cost to be paid by the business men and property owners in the district.

CANTON, OHIO—Improvements are being made to the plant of the Canton Steel Foundry Co., at a cost of about $25,000, which include two core and foundry ovens, additional gas engines and electrical machinery, a locomotive crane and one open-hearth furnace.

CINCINNATI, OHIO—The contract for the electrical work in connection with the apartment building to be erected on Madison Road by C. E. Schaffner, at a cost of $75,000, has been awarded to Fischer Brothers.

CINCINNATI, OHIO—Among the features of the development of a new subdivision on Linwood Avenue by the Frederick A. Schmidt Co. will be the installation of an ornamental lighting system. All electric wires on this property will be placed underground.

CLEVELAND, OHIO — The Tropical Paint & Oil Co., 1246 West Seventieth Street, Cleveland, is planning to erect a power house, 43 ft. by 54 ft., one story, steel construction, to cost about $5,000. C. W. Courtney, Cleveland, is architect.

CYGNET, OHIO—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-light plant in Cygnet.

ELYRIA, OHIO—The installation of high-candle-power nitrogen-filled incandescent street lamps, mounted on ornamental iron posts, maintained by underground wires, throughout the fire district is under consideration by the City Council. It is proposed to use the nitrogen lamps throughout the entire city, but underground wires and ornamental posts will be confined to the business district.

LOWELL, OHIO—The village of Lowell is contemplating the installation of an electric-light system. Electricity for operating the system may be secured from the Kanawha Trac. & El. Co., Parkersburg, W. Va.

SIDNEY, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 8 for construction, including mechanical equipment and approaches, of the United States post office at Sidney, Ohio. Drawings and specifications may be obtained at the above office or from the custodian of site at Sidney.

SPRINGFIELD, OHIO—The local lodge of the Elks is planning to install a small electric generating plant to provide electricity for all purposes in the lodge building. Power will be furnished by the steam-heating plant which will be installed at the same time.

STRUTHERS, OHIO—The Youngstown & Sharon St. Ry. Co., Youngstown, has submitted a new lighting proposal to the Council providing for ornamental lamps on Bridge Street from Yellow Creek to the river bridge and for about 311 lamps to be erected throughout the town.

WEST UNION, OHIO.—Improvements are contemplated by Charles Riffle, owner of the local electric-light plant, which will include the installation of a large crude-oil engine and other equipment.

LANCASTER, KY.—The city of Lexington is contemplating taking over the electric plant, to be owned and operated by the municipality. The Council is considering the purchase of electricity from the Danville Lt. & Pwr. Co. to operate the system.

LOUISVILLE, KY.—An agreement has been reached between the city of Louisville and the Louisville Gas & El. Co. whereby the company is granted a franchise to operate a central steam-heating system for a period of 20 years. The company already supplies steam-heating service in several limited districts.

LOUISVILLE, KY.—To meet the increasing demands for electrical service in the Highlands district the Louisville Gas & El. Co. will erect a brick substation 35 ft. by 70 ft., at Bardstown Road and Stevens Avenue. The initial transforming capacity will be 2000 kw. A number of improvements and extensions will be made to the underground distributing system. At the Waterside steam turbine station a new 1500-kw. motor-generator set will be installed immediately. The engineering department of H. M. Byllesby & Co., Chicago, Ill., will have charge of the improvements.

MAYFIELD, KY.—The proposal to issue bonds for the purchase of the local electric-light and water plants will be submitted to the voters at the coming election. The property was recently appraised at $161,000. Contract has been awarded by the City Council for single-lamp ornamental standards to the Ornamental Foundry Co., Anniston, Ala., at $23.40 per standard.

NICHOLASVILLE, KY.—The installation of an ornamental lighting system on Main Street is under consideration.

BICKNELL, IND.—A company, to be capitalized at $1,000,000, has been organized by A. L. Brocksmith, Bicknell, for the purpose of constructing a power plant at Apraw Falls on White River, two miles south of the city, to supply energy for the coal mines operating in this territory. It also purposes to erect a transmission line connecting the mines.

BURKET, IND.—The committee appointed by the Burket Commercial Club to make investigations relative to the installation of an electric-lighting system in Burket has submitted three proposals to the club as follows: (1) The town to install its own distributing system and to purchase electricity from the Winona Interurban Co.; (2) to enter into a contract with the Winona El. Lt. & Pwr. Co. to furnish the entire lighting service; (3) to join with the towns of Claypool and Silver Lake and incorporate an independent company with the view of supplying electricity to the three towns and to farmers in this territory.

DUNKIRK, IND.—The City Council has adopted a resolution which provides for the installation of a new street-lighting system. Electrical service is supplied by the Muncie El. Lt. Co., Muncie.

INDIANAPOLIS, IND. — Improvements under way in the power department of the Merchants' Ht. & Lt. Co., Indianapolis, include the installation of a large turbo-generator in the west plant, 746 Washington Avenue, and the installation of substation equipment in the building on Court Street formerly occupied by the Claypool garage. The initial installation will have an output of 1500 kw., with provision for an ultimate capacity of 6000 kw. Work has begun on the interchangeable linking of all power plants and substations in the city.

MORGANTOWN, IND.—The Public Service Commission has granted the Morgan County Lt. & Pwr. Co. permission to issue $2,020 in capital stock, the proceeds to be used for the purchase of supplies and equipment, including meters, 50-kw. transformer, copper wire, series street-lighting system and transformer, and street lamps. The headquarters of the company are in Martinsville, Ind.

NAPPANEE, IND.—The Hawks El. Co., Goshen, is negotiating with the town of Nappanee to supply electricity to operate the municipal electric-light system. The municipal plant is unable to meet the demands made upon it.

ELGIN, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, until Oct. 25 for the construction of a power house at the Elgin State Hospital at Elgin. Plans and specifications may be obtained upon application to James B. Dibelka, 130 North Fifth Avenue, Chicago. These proposals are in lieu of the bids received July 26, which were rejected.

GALESBURG, ILL.—The City Council has passed an ordinance calling a special election on Oct. 26 to vote on the proposal to issue $20,000 in bonds, the proceeds to be used for purchasing additional equipment for the municipal electric-light plant.

KANKAKEE, ILL.—The Council committee on street lighting has decided to adopt the new lighting system, advocated by Mayor Alpiner. The Public Service Co. of Northern Illinois furnishes the electrical service in Kankakee.

SPRINGFIELD, ILL.—Bids will be received by Lewis G. Stevenson, Secretary of State, until Oct. 21 for high-pressure piping, heaters, pumps, etc., for the State power plant. Plans and specifications are on file at the office of Martin C. Schwab, consulting engineer, Mallers Building, Chicago.

URBANA, ILL.—Plans are being considered by the Board of Local Improvements for the installation of an ornamental lighting system on West Green Street.

BELOIT, WIS.—The Public Service Commission has authorized the Beloit Wtr., Gas & El. Co. to extend its service to two school buildings in Beloit provided that the city guarantees the company an annual gross revenue sufficient to warrant the expense necessitated by additional line construction until such time as the connection of other consumers in the vicinity increases the annual revenue to the amount now to be guaranteed by the city.

BIRCHWOOD, WIS.—The village of Birchwood is considering the question of installing an electric-lighting system.

DANE, WIS.—The contract for the installation of the electric-lighting system, including substation, street-lighting and commercial lighting distribution system, has been awarded to the Mid Western El. & Mfg. Co., Baraboo. Energy for operating the system will be supplied by the Wisconsin River Pwr. Co., Prairie du Sac.

MILWAUKEE, WIS.—The City Council has passed the resolution providing for an expenditure of $34,000 for the purchase of equipment for a street-lighting system on the West Side.

PORTAGE, WIS.—At a special election held Sept. 28 the proposal to purchase the electric plant of the Portage El. Lt. & Pwr. Co., to be owned and operated by the municipality, was carried.

RICE LAKE, WIS.—The Council has authorized the Red Cedar Valley El. Co. to erect electric lamps on West Eau Claire Street.

BROWNSDALE, MINN. — Application has been made by H. C. Volkman for a franchise to install and operate an electric-light plant in Brownsdale.

GRAND MARAIS, MINN.—A petition has been presented to the Village Council asking that an election be called to submit to the voters the proposal to issue bonds for the installation of a municipal electric-light plant.

LAKELAND, MINN:—The installation of an electric-lighting system in Lakeland is reported to be under consideration.

ST. CLOUD, MINN.—Bids will be received by the St. Cloud Independent School District, No. 28, addressed to Julius Adams, secretary of board, St. Cloud, until Oct. 25, for construction of high-school building as follows: (a) General contract; (b) plumbing contract; (c) electric contract; (d) heating contract; (e) ventilating contract; (f) sheet-metal contract; (g) temperature regulation; (h) fans, motors and heaters; (i) vacuum heating system. Plans and specifications may be obtained upon application to Tyrie & Chapman, architects, Minneapolis, accompanied by a deposit of $25 for general contract, of which $17.50 will be refunded upon return of plans; deposits of $15 for each set of plans for (b), (c) and (d), the latter including work required in contracts (e), (f), (g), (h) and (i), of which $10 will be refunded upon return of plans.

THIEF RIVER FALLS, MINN.—The city of Thief River Falls is contemplating the purchase of the so-called Kretschmar dam and water-power site in this city. If the property is purchased, extensive improvements are contemplated, including the rebuilding of the municipal hydroelectric power plant. Ralph D. Thomas, Minneapolis, is consulting engineer. Leonard Peterson is superintendent of water and light department.

WABASHA, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Oct. 19, for construction of a tuberculosis sanitarium at Wabasha, including general construction, heating, plumbing and electrical work, in accordance with plans and specifications made by Hoffman & Mosse, Rochester, Minn.

CEDAR FALLS, IOWA—Plans are being considered for extending the ornamental lighting system on Main Stret.

CORINTH, IOWA—The city of Corinth, it is reported, has voted to issue bonds for the installation of an electric-light plant.

JOLLEY, IOWA—The contract for the erection of 7 miles of 2300-volt single-phase transmission line from the town of Pomeroy to Jolley, and also for furnishing material

and installing an electrical distribution and street-lighting system in Jolley, it is reported, has been awarded to F. E. Tedford, Gowrie, Iowa.

KANAWHA, IOWA.—At an election to be held Oct. 20 the proposal to issue bonds to the amount of $13,000 for the construction of a municipal electric-light system, including high-tension transmission lines, transformer station and distribution system, will be submitted to the voters.

OTTUMWA, IOWA—The Ottumwa Ry. & Lt. Co. is installing a 200-kw, engine-driven generator and is also making improvements in the boiler room. The work is being done under the supervision of the engineering department of H. M. Byllesby & Co., Chicago, Ill.

JOPLIN, MO.—The Public Utilities Commission of Kansas has granted the Empire District El. Co., Joplin, Mo., permission to extend its electrical service in Cherokee County, which will include furnishing energy to the new mines in Baxter Springs district. The cost of the work is estimated at about $33,000.

MAPLEWOOD, MO.—The Western Pwr. & Lt. Co., a subsidiary of the Cupples Station Pwr. Co., has been awarded the contract for lighting Maplewood for a period of ten years. The El. Co. of Missouri, Webster Groves, has the present contract.

MILAN, MO.—Steps have been taken by the Commercial Club to secure funds for the installation of an electric street-lighting system.

POPLAR BLUFF, MO.—Bids will be received by H. H. Wilcox, city clerk, Poplar Bluff, until Nov. 3 for the construction of a municipal electric light and power plant. Bonds to the amount of $75,000 have been sold for the proposed plant. The Fuller-Coult Co., Chemical Building, St. Louis, has charge of the engineering work.

ST. JOSEPH, MO.—The City Council has passed an ordinance appropriating $5,000 for ornamental lamp-posts and conduits on Noyes Boulevard.

GRAND FORKS, N. D.—A deal has been consummated whereby the Red River Pwr. Co., Grand Forks, will secure energy from the hydroelectric power plant of the Crookston Wtr. Wks., Pwr. & Lt. Co., Crookston, Minn. A high-tension line (28 miles long) is now being erected from Grand Forks to the power plant, near Crookston. A substation will be erected here and additional machinery installed in the Crookston plant, including three turbines and generators. W. H. Brown is manager of the Red River Pwr. Co.

WASHBURN, N. D.—The Washburn Lt. & Pwr. Co. has been granted a franchise to construct and operate an electric light and power plant in Washburn.

WATFORD, N. D.—Fred Hermanson, superintendent of the White Earth Electric Association, has been awarded a contract to install an electric-lighting system in Watford.

VOLIN, S. D.—A company is being organized by citizens of this place for the purpose of installing and operating an electric-lighting and power plant.

PAWNEE CITY, NEB.—The city of Pawnee has entered into a contract with the village of Dubois to supply electricity from the municipal electric-light plant in that village. Bonds have not been authorized for improvements to municipal electric plant as published in the issue of Oct. 2.

ATWOOD, KAN.—Plans and specifications have been prepared by Black & Veach, Interstate Building, Kansas City, Mo., for the installation of a municipal electric-light plant, for which bonds to the amount of $15,000 have been voted. Bids will soon be called for construction of the proposed plant. Frank E. Robinson is city clerk.

BURRTON, KAN.—The City Council has granted the Kansas Gas & El. Co., Wichita, a franchise to supply electricity for lamps and motors in Burrton.

EVEREST, KAN.—The contract for erecting the transmission line from Effingham to Everest has been awarded to Jesse Maim. Electricity for operating the system in Everest will be supplied by the plant of the Atchison Ry., Lt. & Pwr. Co. in Atchison.

GARDEN CITY, KAN.—The City Commission has decided to call an election to submit to the voters the proposal to issue $60,000 in bonds for the purchase of the electric-light plant and telephone system of the Garden City Tel., Lt. & Mfg. Co.

HAVENSVILLE, KAN.—Bonds to the amount of $8,000 have been voted for the erection of a transmission line and electric-lighting system.

KANOPOLIS, KAN.—Plans are being prepared for the installation of an additional boiler in the municipal electric-light plant. Further information may be secured from J. F. Branson, superintendent.

Southern States

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 20 for furnishing two shipbuilding cranes at the navy yard, Charleston, S. C. Plans and specifications may be obtained upon application to the bureau or to the commandant of the navy yard named.

TOCCOA, GA.—Contracts have been awarded by the city of Toccoa for construction of a municipal electric-light plant as follows: For power house and flume, to J. G. Phillips, Cornelia, at $3,766; for erection of transmission line from power site to town, street-lighting system and ornamental lighting system, to the Walker El. & Plumbing Co., Rome, at $15,185. S. D. Brown is engineer.

AFTON, TENN.—Preparations are being made, it is reported, by the L. D. Gastiger Co. for the construction of a dam (to cost $100,000) on the Chucky River, near Afton, in connection with a hydroelectric project.

JACKSON, MISS.—R. L. Benson, Chicago, Ill., owner of the power plant of the Capital Lt. & Pwr. Co., Jackson, will reconstruct the system and put it in operation about Dec. 1. Between $10,000 and $15,000, it is reported, will be expended for the purchase of new machinery and for extension and rebuilding of distribution lines. E. E. Hindman, Jackson, is attorney for Mr. Benson.

McCOMB, MISS.—The property of the McComb City El. Lt. & Pwr. Co., it is reported, has been purchased by Guy M. Walker of New York. The new owner, it is understood, will make improvements to the system. S. M. Jones, Laurel, is local representative.

EARL, ARK.—The property of the Crittenden Pwr. Co., Earl, has been purchased by a group of Memphis capitalists, headed by J. G. Freeman, for $30,000. The company has been reorganized under the name of the Earl Lt., Pwr. & Ice Co.

GRAVETTE, ARK.—Plans are being considered by the City Council for the installation of new engines for the municipal electric-light plant.

MORRILLTON, ARK.—The Arkansas Lt. & Pwr. Co., Arkadelphia, is reported to have purchased the electric-light plant and water-works system in Morrillton and will make improvements to it.

COLFAX, LA.—The Big Pine Lumber Co. is planning to rebuild its power plant, which was recently destroyed by fire. New equipment, it is understood, will be required.

COMANCHE, TEX.—The Texas Pwr. & Lt. Co., Dallas, has been granted a franchise to supply electricity for lamps and motors in Comanche. The service will be furnished by means of an electric line from Brownwood. Several small towns between Comanche and Brownwood will be served.

LULING, TEX.—The Luling El. Lt. & Pwr. Co., it is reported, is contemplating the installation of a new street-lighting system.

ROYSE, TEX.—Arrangements have been completed whereby the Texas Pwr. & Lt. Co., Dallas, will take over the electrical plants in Rockwell, Garland and Royse. A transmission line will be erected from Royse to Jenkins, connecting with the present 33,000-volt line of the company. Surveys will be made at once for the proposed line, which will be about 20 miles long.

Pacific States

PORT ANGELES, WASH.—The City Council has instructed the city attorney to prepare the necessary data for the action of the City Council in regard to placing before the voters at the December election the question of validating approximately $28,000 in outstanding electric-light warrants and issuing bonds to take up same. This proposition is offered as the only solution to the electric-light extension problem, which has been considered for about a year. It is desired to make extensions immediately to the lighting service.

SEATTLE, WASH.—The City Council has passed a resolution authorizing the Board of Public Works to seal the leaky impounding basin at the Cedar River dam by silting or other means, and appropriating $25,000 for that purpose. The work, it is understood, will be done under the supervision of J. D. Ross, superintendent of lighting.

TACOMA, WASH.—The City Council has decided to sell electrical energy to the Mutual El. Lt. & Pwr. Co. for distribution among the Puyallup valley ranchers. Electricity will be taken over by the company at a point near the Cushman Indian School.

ALBANY, ORE.—Application has been made to the City Council by a group of capitalists, headed by William Hoeflich, for an electric light and power franchise in Albany.

CORNUCOPIA, ORE.—The Baker Mines Co., it is reported, is planning to install a hydroelectric plant on Pine Creek to supply electricity to operate an air compressor and milling machinery. Approximately 10,000 ft. of pipe line will be built and two water-wheels and other equipment will be installed. The plant will have an output of from 400 hp. to 500 hp.

EUGENE, ORE.—The installation of an auxiliary electric plant has been authorized by the Eugene Water Board, to cost about $50,000.

CROCKETT, CAL.—The Great Western Pwr. Co., San Francisco, has petitioned the State Railroad Commission for permission to erect an extension of its transmission lines to the premises of the Western Grain & Sugar Products Co., near Crockett.

LATON, CAL.—The San Joaquin Lt. & Pwr. Co., Selma, has submitted a proposal for lighting the streets of Laton, which provides for the installation of 25 nitrogen-filled incandescent lamps of 100 cp.

OROVILLE, CAL.—Arrangements, it is reported, have been made by the Great Western Pwr. Co., San Francisco, for the purchase of the power plants and distributing system of the Oro El. Co., Oroville.

PHOENIX, ARIZ.—Bids have been asked by the city manager for not less than 25 or more than 300 ornamental electric-lamp standards in accordance with plans prepared by the city engineer.

MOGOLLON, N. M.—The construction of an electric power plant on Willow Creek is reported to be under consideration by Earle C. Cleveland.

Canada

BEAUSEJOUR, MAN.—The village of Beausejour has decided to take over the transmission line between Saldo and Beausejour, owned by the city of Winnipeg, at a cost of $7,500. A by-law has been passed by the village providing for an appropriation of $15,000 for the purpose of acquiring the line and installing an electric-lighting system here. M. J. Hobon is clerk.

CHATSWORTH, ONT.—The Council is considering a by-law providing an appropriation of $4,000 for the installation of a hydroelectric system.

ETOBICOKE, ONT.—Arrangements have been made by the Township Council with the Mimico Power Commission, Mimico, for the extension of the system to Humber Bay. The transmission line will be erected along George and Church Streets, at a cost of about $1,500.

LONDON, ONT.—Tenders, it is reported, will soon be asked for furnishing the supply of new transformers for the new Hydro-Electric station.

PORT COLBORNE, ONT.—A by-law authorizing an agreement with the Ontario Power Commission of Ontario to supply electricity to Port Colborne and Humberstone for a period of five years has been approved by the ratepayers of Port Colborne and Humberstone.

Miscellaneous

SEWARD, ALASKA—The differences between the Town Council and the Seward El. Lt. & Pwr. Co. over the granting of a franchise permitting the company to continue operation in Seward have been amicably adjusted, according to reports, and the franchise granted. Under the terms of the franchise the town of Seward can purchase the property of the company at the end of 20 years.

HONOLULU, HAWAII—Plans are being considered by the East Maui Irrigation Co., operating in the island of Maui, for the construction of a hydroelectric power plant in the Koanae Valley to supply electricity to operate the irrigation pumps.

PANAMA—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Oct. 27 for furnishing traveling crane, annunciators, buzzer push units, copper tubing, flexible copper or brass conduit, carbon brushes, etc. Blanks and general information relating to this circular (No. 978) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 5, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,155,338. DETECTOMETER; A. G. Carlson, North Easton, Mass. App. filed June 11, 1913. For adjustable contacts used in wireless work.

1,155,345. MEANS FOR SMOOTHING AND IRONING THE INSULATING WRAPPING OF ELECTRICAL CONDUCTORS; A. Finckbein, Charlottenburg, Germany. App. filed Jan. 6, 1913. Protects conductors while pressing insulation firmly in place.

1,155,350. ATTACHMENT OF ELECTRICAL FIXTURES TO OUTLET BOXES; H. R. Gilson, Baden, Pa., and J. M. Fullman, Sewickley, Pa. App. filed Aug. 31, 1914. Particularly for metal molding.

1,155,358. PROCESS OF MANUFACTURING ARTICLES OUT OF HIGHLY REFRACTORY MATERIAL; P. M. Hulbert, Detroit, Mich. App. filed Sept. 24, 1906. Compacts and then heats comminuted material.

1,155,364. ELECTRIC SWITCH; J. F. Monnot, Paris, France. App. filed July 14, 1911. Operated by Bourdon tube.

1,155,373. TRACK INSTRUMENT; J. S. Romig, Altoona, Pa. App. filed Oct. 31, 1914. Crossing signal operated by the load on the rails.

1,155,415. LIGHTNING ARRESTER; J. T. Greene, Toledo, Ohio. App. filed Aug. 5, 1913. Is protected from injury.

1,155,419. MANUFACTURE OF PURE CARBON; H. Hennebutte, Paris, France. App. filed Feb. 21, 1914. Treats heated hydrocarbons with oxidizing gas.

1,155,423. ELECTRIC FLATIRON; W. K. Keep, Detroit, Mich. App. filed Jan. 29, 1915. Novel terminal connections.

1,155,426. METHOD OF MAKING CONTACT BODIES OF TUNGSTEN; A. J. Liebmann and W. A. Megrath, New York, N. Y. App. filed Nov. 20, 1914. Heats tungsten contact and supporting back with powdered tungsten between.

1,155,427. CONTACT BODIES OF TUNGSTEN; A. J. Liebmann and W. A. Megrath, New York, N. Y. App. filed Nov. 20, 1914. Tungsten contact welded to iron or steel support.

1,155,448. ELECTRIC PLATE CONDENSER; G. Selbt, Schöneberg, near Berlin, Germany. App. filed Oct. 17, 1911. Of reduced size for wireless work.

1,155,460. ARMOR FOR FLEXIBLE ARTICLES; C. Barbour, Pittsburgh, Pa. App. filed Feb. 15, 1913. Inner and outer helices of different pitch.

1,155,466. ELECTRIC DISPLAY SWITCHING MECHANISM; E. H. Bickley, Detroit, Mich. App. filed Dec. 23, 1912. For "motograph" signboard.

1,155,477. MANUAL ACTUATOR FOR RAILWAY SIGNALS; T. M. Freeble, Rochester, Pa. App. filed Oct. 8, 1912. Budging device applied to track wheel to send back signal.

1,155,480. RANGE; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 9, 1914. Interchangeable heat units.

1,155,481. REGULATOR FOR LAUNDRY ROLLS; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed May 14, 1914. Controlling thermometer embedded in the periphery of the roll.

1,155,482. HEAT-REGULATING SYSTEM; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed April 17, 1914. For crucibles of type-setting machines.

1,155,483. ELECTRIC HEATER; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed May 20, 1914. Has soapstone heat-absorbing body.

1,155,484. MOTOR-CONTROL SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed March 7, 1914. Dynamic braking switch.

1,155,494. TOASTER; J. F. Lamb, New Britain, Conn. App. filed March 25, 1915. Readily assembled.

1,155,497. ELECTRIC WELDING MACHINE; W. C. Lindemann and K. D. Camp, Milwaukee, Wis. App. filed Feb. 18, 1913. Spot-welding.

1,155,500. CO-ORDINATING ACTUATING MEANS FOR MAGNETOS AND IGNITERS OF INTERNAL-COMBUSTION ENGINES; T. C. Menges, Waterloo, Iowa. App. filed Oct. 27, 1913. Creates strong current at exact time of ignition.

1,155,501. RECORDING INSTRUMENT; C. R. Moore, Lafayette, Ind. App. filed May 24, 1913. Electromagnetic recording elements operate on paper tape.

1,155,502. ELECTROMAGNET; C. R. Moore, Lafayette, Ind. App. filed May 24, 1913. Single armature presented to two magnetic circuits.

1,155,512. PRIMARY BATTERY; A. L. Saltzman, East Orange, N. Y. App. filed Feb. 20, 1911. Rigid supporting means for the electrode plates.

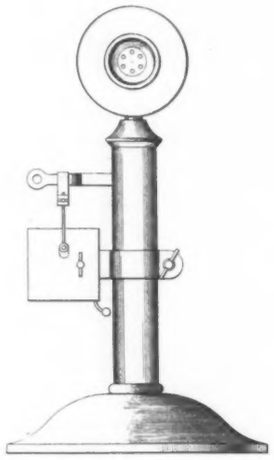
1,155,521. MAGNETO-ELECTRIC MACHINE; F. R. Simms, Kilburn, England. App. filed Feb. 21, 1912. Lighting-current armature superposed above ignition-current armature.

1,155,535. TRAIN-CONTROLLED ELECTRIC RECORDING CROSSING SIGNAL; H. Wilkins, Evansville, Ind. App. filed Nov. 29, 1912. Includes clock-recording mechanism.

1,155,547. ELECTRIC SIGNALING SYSTEM; A. H. Bull, Brooklyn, N. Y. App. filed June 25, 1910. "Regular" and "special" impulses for selective signaling.

1,155,560. TREATMENT OF SEED GRAIN; H. E. Fry, Dorchester, England. App. filed March 27, 1915. Placed in solution of manure through which electric current is sent.

1,155,578. FALSE-ALARM-PREVENTING DEVICE; J. Janik, Plymouth, Pa. App. filed June 9, 1915. Grips operator's hand.



1,155,722—Fire-Alarm System

1,155,593. ELECTRICAL HEATER; A. W. Mansbridge, Winnipeg, Manitoba, Canada. App. filed March 3, 1915. Can be used as radiator or stove.

1,155,626. SWITCH; H. A. Steen, Milwaukee, Wis. App. filed Nov. 2, 1910. Has a simple and compact blow-out magnet.

1,155,640. IMPULSE TRANSMITTER FOR SELECTIVE SYSTEMS; G. Brown, Brooklyn, N. Y. App. filed July 11, 1910. Compact, sure and quiet in operation.

1,155,643. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed May 6, 1911. Regulating means is adjusted only in response to sudden surgings.

1,155,648. MEANS FOR PROTECTING CONTENTS OF OIL-CONTAINING TANKS AGAINST IGNITION BY ELECTRICAL DISCHARGE; W. Dodd, Des Moines, Iowa. App. filed Nov. 5, 1913. Tank is surrounded by an electrically conductive casing extended down into the ground.

1,155,649. RECTIFIER COMPOUND; N. Fallek, Denver, Col. App. filed Oct. 12, 1912. Sodium phosphate, asbestos, sodium silicate and water.

1,155,653. METHOD AND APPARATUS FOR UTILIZING HERTZIAN WAVES; E. R. Gill, Yonkers, N. Y. App. filed Feb. 20, 1914. Telephone, directing torpedoes, etc.

1,155,656. AIR-COOLED TANK FOR ELECTRICAL APPARATUS; I. Harter, New York, N. Y. App. filed Dec. 23, 1913. Flattened cooling tubes project outwardly from walls of tank.

1,155,672. TELEPHONE EXCHANGE SYSTEM; T. G. Martin, Chicago, Ill. App. filed May 6, 1910. Automatic party-line system.

1,155,695. TROLLEY GUARD; J. Zanolli, Pittsburgh, Pa. App. filed June 2, 1914. Pivoted guard finger.

1,155,716. WIRE SUPPORT; A. F. Fest, Audubon, Iowa. App. filed Sept. 5, 1914. Special construction for mounting on telegraph poles.

1,155,722. FIRE-ALARM SYSTEM; F. Gottschalk, Stirling, N. J. App. filed Sept. 19, 1914. Fusible link releases receiver hook.

1,155,742. METER-PROTECTION DEVICE; E. A. LeFever, Buffalo, N. Y. App. filed July 25, 1913. Covering and sealing of meter connections.

1,155,789. LIGHTING FIXTURE; F. M. Brooks, New York, N. Y. App. filed Nov. 30, 1914. Clamps for gripping edge of bowl.

1,155,812. ELECTRIC INSULATION; J. A. Heany, New York, N. Y. App. filed Sept. 23, 1914. Fiber-coated filamentary body wrapped about conductor.

1,155,813. ELECTRIC INSULATION; J. A. Heany, New York, N. Y. App. filed Sept. 23, 1914. Inclosing flat sheath of matted asbestos fibers.

1,155,814. ELECTRIC SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed July 15, 1910. Has special arc-interrupting means; for heavy currents.

1,155,817. CAR INDICATOR; H. A. Humphrey, Kansas City, Mo. App. filed July 19, 1909. For position and direction of elevator cars.

1,155,826. ADJUSTABLE RESISTANCE; E. C. Larry, Rochester, N. Y. App. filed June 26, 1915. For railway-track circuits.

1,155,834. RAILWAY AND HIGHWAY SIGNALING DEVICE; A. H. Messer, Mankato, Minn. App. filed March 24, 1915. Operates a semaphore and an adjacent highway signal.

1,155,835. ELECTRICAL SCROLL SAW; G. H. Murphy, Balls Ferry, Cal. App. filed Jan. 26, 1915. Cutting member of high-resistance material.

1,155,849. MANUFACTURE OF STEEL; William R. Walker, New York, N. Y. App. filed Aug. 24, 1909. Avoids addition of manganese.

1,155,869. GONG; C. E. Avery, Trenton, N. J. App. filed Aug. 5, 1914. Striking mechanism construction.

1,155,913. TROLLEY WHEEL; W. S. Griffith, Homer City, Pa. App. filed Dec. 12, 1913. Revolvable members over groove in wheel.

1,155,921. REVERSIBLE BRUSH HOLDER; G. L. Halvardson, Stockholm, Sweden. App. filed July 29, 1911. Alternating-current motor for bell-ringing purposes.

1,155,963. ELECTRIC LAMP; O. Schaller, Sudende, near Berlin, Germany. App. filed Jan. 20, 1913. Lamp casing whose parts are held together by atmospheric pressure.

1,155,978. DRUM SWITCH WITH MAXIMUM CUT-OUT; M. Vogelsang, Frankfort-on-the-Main, Germany. App. filed Dec. 8, 1914. Pawl and ratchet thrown out by maximum relay.

1,155,985. CENTRIFUGAL SWITCH; H. L. Zabriskie, Westfield, N. J. App. filed July 10, 1913. Sensitive springs control pivoted contact fingers.

1,156,035. ELECTRICAL TRANSFORMER SYSTEM; F. S. Perrin, New York, N. Y. App. filed Sept. 25, 1913. Abolishes customary make and break in primary of ignition system.

1,156,043. TELEGRAPH SYSTEM; W. H. Shephard and A. E. McKechnie, Bayswater, London, England. App. filed March 4, 1915. Selector operates only on predetermined signal.

13,990 (reissue). MECHANICAL MOVEMENT AND ELECTRIC-LIGHT SOCKET; T. A. C. Both, Fairhaven, Mass. App. filed Oct. 1, 1912. Rey-socket switch mechanism.